DISTANT VISTAS: BRADFORD WASHBURN, EXPEDITIONARY SCIENCE AND LANDSCAPE 1930-1960

A

THESIS

Presented to the Faculty

of the University of Alaska Fairbanks

in Partial Fulfillment of the Requirements

for the Degree of

DOCTOR OF PHILOSOPHY

By

Michael P. Sfraga, B.S., M.A.

Fairbanks, Alaska

May 1997

UMI Number: 9725098

UMI
300 North Zeeb Road
Ann Arbor, MI 48103

DISTANT VISTAS: BRADFORD WASHBURN,

EXPEDITIONARY SCIENCE AND LANDSCAPE 1930-1960

By

Michael P. Sfraga

RECOMMENDED:

Ralph Gabrielli

Advisory Committee Chair

Department Head

APPROVED:

Dean, College of Liberal Arts

Dean of the Graduate School

4-22-97

Date

ABSTRACT

Bradford Washburn is primarily known for his Alaskan mountaineering accomplishments and mountain photography. Between 1930 and 1960, Washburn led 19 expeditions to Alaska and Canada's Yukon Territory on which he surveyed, photographed and mapped some of the last unexplored mountain regions in North America. This study, however, analyzes Washburn's lesser known role in directing interdisciplinary field research involving high altitude physics, glaciology, cartography and geology, which he accomplished by linking such disparate entities as the motion picture industry, geographic organizations, the U.S. military, and prominent U.S. scientists.

Washburn's career can be viewed as an intersection of nineteenth and twentieth century geographic traditions. He combined emerging technologies with new and innovative vehicles of exploration to more accurately study geological, geographical and environmental phenomenon in mountainous regions. During the Second Great Age of Discovery, which began with the Renaissance, explorers ventured into the heart of the world's continents by utilizing various vehicles of exploration such as canoes and pack animals.

This style continued into the middle of the twentieth century when the present day Third Great Age of Discovery, characterized by the use of remote sensing platforms and space age satellites, allows for a more accurate geographic study and inventory of our planet. Washburn's interdisciplinary field work reflects the fundamental goals and patterns of expeditionary science found in both ages of discovery.

In this study three important themes are examined: Washburn's role as innovative field scientist; geography as a disciplinary bridge; and the work of the independent geographer. By analyzing Washburn's work in the pre World War Two and Cold War era, we gain an understanding of the ways in which expeditionary science was funded and carried out within two fundamentally different political and economic frameworks.

Moreover, this study provides an important window into our understanding of interdisciplinary earth sciences in the mid twentieth century. It also explores the often unappreciated link between environmental science and geography in the American context.

TABLE OF CONTENTS

PREFACE

Along Boston's Charles River stands a monument to the tireless efforts of countless volunteers and donors who shared in one man's vision -- a vision to create a science museum where children and adults could explore and experience the natural world. Bradford Washburn's plan for the Museum of Science began in 1939 when, at the age of 29, he assumed its directorship. Throughout the next forty-one years he carefully and purposefully transformed a quaint natural history museum into a thriving international institution of interactive and informative displays that demystify the world of science for hundreds of thousands of visitors each year.

I first met Bradford Washburn nearly ten years ago on a cold, damp February New England evening. Washburn, a boyhood hero of mine, had long been a giant in the world of mountaineering and his name and reputation were synonymous with the history and exploration of Mount McKinley -- North America's tallest mountain. As a young boy in Brooklyn, New York, I spent many hours on our family's front stoop immersed in the pages of Terris Moore's now classic book *The*

Pioneer Climbs of Mount McKinley.[1] The book had an indelible impact on my life; it not only opened the world of mountaineering to me, but it lured me north to Alaska, the home of Mount McKinley. At that time, I had no idea that years later I would become friends with two of the book's subjects.

The author, Dr. Terris Moore, had served as president of the University of Alaska Fairbanks from 1949 through 1953 and, in the 1930's and 1940's, was one of America's foremost mountaineers. I had the pleasure and honor of spending many memorable weeks in his home, sharing and recording many of his accomplishments. I will be forever grateful for his kindness and for the opportunity to tell him, prior to his death, the positive impact his book had on my life. This, of course, is not the subject of the work at hand but it should be noted that it was Moore who convinced a hurried Bradford Washburn to meet with me so many years ago.[2]

---

[1] Terris Moore, *The Pioneer Climbs of Mount McKinley* (Fairbanks: University of Alaska Press, 1967).

[2] Over the course of several years, I have conducted numerous oral history interviews with Bradford Washburn, Terris Moore and other prominent American Mountaineers. These interviews eventually will be deposited in the Rasmusen Library of the University of Alaska Fairbanks.

On that dreary New England evening, I negotiated through hordes of school children and frantic teachers amassed in the museum's lobby, eventually making my way below a walkway which spans the breadth of this large open area. Engraved in the walkway's arch is a dedication to the tireless efforts of Bradford Washburn, and his wife Barbara. The museum's trustees chose to honor the couple for their instrumental work in the creation of this now vibrant institution. I soon realized that Mount McKinley was not Washburn's only passion. He had, in ways I had yet to discover, fashioned multiple career paths as a pioneer explorer, a science educator and an administrator. The singularly focused mountaineer that I envisioned did not exist. My perception, born from the pages of books and journals, was far too narrow and restrictive. In the years that followed, I discovered the many sides and talents of Bradford Washburn -- the explorer, administrator, visionary, entrepreneur, photographer and educator. Almost as striking as his list of talents and attributes is the ease in which he transforms from one role to another. This dissertation explores these various aspects of Washburn's career, and places them within an institutional, professional and interdisciplinary context in modern America.

Washburn's office overlooks the Charles River. With thinning gray hair and slight build, he was not a physically daunting individual, but he was every bit as intense as I had imagined. It was not long before we were engaged in a rather lengthy and spirited conversation regarding the world's mountains and, in particular, Mount McKinley. From that day forward, we have enjoyed a close personal and professional relationship. As a result of this relationship, he has allowed me unrestricted access to his private diaries, photographs, letters and papers. Through his generosity, these materials now constitute the core of the Bradford Washburn Collection in the Alaska and Polar Regions Archives of the University of Alaska Fairbanks. In many instances, he has allowed me access to these materials prior to their inclusion in his collection. I am forever grateful to Brad and his wife Barbara Washburn, for their friendship, trust and commitment to me and to the University of Alaska Fairbanks.

Bradford Washburn is a dynamic and unique individual whose genius is easily identifiable. Mountaineering historian Audrey Saulkeld has likened Washburn to a renaissance man.[3] Indeed, he is a complex mix of intellect, physical and

---

[3] Audrey Saukeld, "Skinning One Skunk at a Time," *Mountain* 126, March/April 1989, 36.

mental fortitude, and perfectionism. Washburn is a cunning and critical thinker, a graceful and effective communicator, and an efficient and creative field scientist, educator and visionary: "You recognize the explorer in Bradford Washburn at first sight," noted celebrated American photographer Ansel Adams, "There is something about his eyes, the set of the chin... the consistent energy of mind and spirit."[4] For nearly eight decades this energy has fueled an internal fire of desire for scientific exploration and geographic discovery.

Washburn's career has evolved from years of dedicated work, detailed preparation and encyclopedic, uncanny knowledge of his subject. He has led dozens of expeditions with the same precision and grandeur evident in the works of the world's great musicians. Indeed, he has "conducted" great orchestras of mountaineers and scientists high atop the mountains of Alaska, Canada, Nepal and the eastern United States. His results include beautiful concertos of stunning photographs and maps and thunderous crescendos of first ascents. At the very core of each of Washburn's expeditions can be found a few primary motifs -- a fundamental love for high and distant places, the yearning to experience the unknown and

---

[4] Bradford Washburn and David Roberts, *Mount McKinley: The Conquest of Denali* (New York: Harry N. Abrams, 1991), 17.

the desire to share the world's natural beauty and scientific wonders.[5] I hope that this dissertation will provide a substantive discussion and analysis of Washburn's contributions to our understanding of the natural world and allow insight into the professional career of one of America's most celebrated geographic explorers.

Throughout this study I have tried to stay objective, minimizing, as best as possible, my personal relationship with Bradford Washburn, so that a fuller and more accurate portrayal of the man and his role within twentieth century expeditionary science may be presented. However, it would be naive to believe that such a self imposed filter is capable of straining out inherent biases that, no doubt, have evolved over my nearly decade-long affiliation with him.
I have tried to represent not only the positive aspects of his work but the comments and thoughts of individuals critical of either his motives and methods, or those who have questioned the significance of his scientific and geographic investigations. Although no researcher is immune to such realities, I have attempted to provide a balanced approach to this work.[6]

---

[5] Bradford Washburn, interview with Mike Sfraga, Tape recording, 15 July, 1992, Boston, Massachusetts.
[6] As previously noted, I have conducted numerous oral histories with Washburn. There are, however, interesting

Wherever possible, I have used original sources (including personal diaries, manuscripts, correspondence and interviews) to portray various themes regarding Washburn's participation in and impact on expeditionary science and geographic exploration. By concentrating this study to the years 1930-1960, I have endeavored to capture the most dynamic and perhaps most important period of Washburn's work. This time frame is also significant in that one may explore geographic exploration and scientific trends and funding in a period that experienced a global economic depression, a second world war and the emergence of a political and military cold war -- all precursors to the era of Big Science.

ACKNOWLEDGMENTS

A study such as this would not have been possible without the support and assistance of a number faculty members and

---

issues related to the acquisition, utilization and accuracy of such forms of "history." See S.S. Schweber, "Writing the Biography of a living Scientist: The Challenges and the Reward," paper presented at the "Interviews in Writing Recent Science," conference, Stanford University, 28-30 April, 1994; Thomas Soderquist, "After the 200th Hour: The A/Effects of Long-Term Interviewing for Science Biography," paper presented at the "Interviews in Writing Recent Science" conference, 28-30 April, 1994.

academic departments at the University of Alaska Fairbanks - it is a product whose implications reach far beyond these pages. I thank Dr. Judith Kleinfeld, Director of the Northern Studies Program at the University of Alaska Fairbanks, for sharing my enthusiasm and vision in creating an interdisplinary Ph.D. program in which broad questions regarding the North may be addressed. My academic goals could not have been realized without Dr. Kleinfeld's immeasurable support. I extend my sincere appreciation to Dr. Roger Pearson, my advisor and committee chair, for his tireless efforts and willingness to take on a research program that was both interdisciplinary in nature and design. Without his support, vision and critical review, my work would not have been possible. The scholarship, advice and objective encouragement of Dr. Marvin Falk brought focus to my academic program by introducing me to the history of science.

Dr. Ralph Gabrielli provided friendship, support and encouragement throughout my studies. Dr. Gabrielli's critical analysis of this study brought creativity and refinement to the final product. Dr. Jack Townshend provided practical counsel regarding the history of expeditionary field science and enthusiastic support of the broad themes presented in this work. Dr. Ron Doel was instrumental in framing and directing the broad themes that have been examined in this study. His careful guidance has been instrumental in my work.

To Dr. Kleinfeld, Dr. Pearson, Dr. Falk, Dr. Gabrielli, Dr. Townshend and Dr. Doel, I thank you for your support, guidance and your unwavering belief in my work. As is often the case, these words can not fully express my gratitude for the opportunity you have provided me.

I would like to thank the following individuals who allowed me to conduct oral histories that brought depth and breadth to this work: Dr. Terris Moore and his wife, Katrina, Robert Bates, Charley Houston, Major William Hackett, US Army (ret.), H. Adams Carter and his wife, Ann, and Dr. William Field. I would also like to thank various faculty members and colleagues for engaging and insightful discussions on various topics related to my research: Dr. Carl Benson, Dr. William Harrison, Dr. James Gladden, Dr. William Schneider, Dr. Fay Korsmo, Dr. Terrence Cole, Dr. Troy Pewe', Dr. Spencer Weart, Dr. David DeVorkin, Dr. William Hunt, and a special thanks to my colleague, Tanya Levin.

I would also like to acknowledge the help of the following individuals and institutions which provided critical research assistance: Marge Heath, Gretchen Lake and Dr. Susan Grigg of the Alaska and Polar Regions Archives, University of Alaska Fairbanks; Caroline Mosley, American Institute of Physics; Mary Anne McMillen, National Geographic Society; the staff and archivists of the Harvard University Archives, Franklin Delano Roosevelt Library, Denver Public Library, Center for Military History, and the National Archives.

Ann Tremarello has been a faithful supporter and critical part of my graduate work. Indeed, the gratitude and respect I have for her can not adequately be put into words. To Ann, this work is as much a reflection of your love and support as it is a product of my academic pursuits.

My love and thanks to my mother and father who encouraged me to follow my dreams. Megan and Hanna, I love you and thank you for letting me be an absentee daddy. To my wife, Evelyn, who has endured what each spouse of a graduate student endures -- my deepest admiration, love and appreciation for allowing me to fulfill a dream -- you have given me the greatest gift of all.

INTRODUCTION

Bradford Washburn's career can be viewed as an intersection of twentieth century geographic exploration and field science. Washburn is an explorer who understands the scientific and aesthetic value of photographs - sharing this passion with such colleagues and friends as renowned American Photographer Ansel Adams. He is an entrepreneur who brings together scientists of varied disciplines, such as astrophysicist Dr. Harlow Shapley (former director of the Harvard College Observatory), and experts from many other areas, to carry out broad interdisciplinary field work. This study will illuminate these and other themes and their synthesis in mid twentieth century America.

A general review and analysis of late nineteenth and early twentieth century exploration is needed to construct the framework for this study. This review will provide a critical context for the broad national and societal trends and illuminate the public's general perceptions regarding geographic exploration at the time. This is important because Washburn grew up when the American public was consumed by great tales of geographic discovery and scientific breakthroughs -- two key factors in his early development and formative years. Moreover, such a review will provide the means for fuller understanding and appreciation of Washburn's place among the great explorers of this era.

Throughout the second decade of the twentieth century, the most outstanding geographic accomplishments had been made by a few of the most ingenious, ardent and often stubborn explorers. For centuries, the conquest of both geographic Poles and the Northwest Passage captured the imagination of entire nations. To the victorious explorer lay the promise of fame and financial reward, while those not as fortunate were afforded far less.[7]

From 1903-1907, famed Norwegian explorer Roald Amundsen successfully navigated for the first time the Northwest Passage aboard the ship Gjoa. In 1911, along with two fellow countrymen, he was the first to reach the geographic South Pole.[8] However, these accomplishments were rather hollow for

---

[7] For a broad overview of exploration and explorers, see L.P. Kirwin, *A History of Polar Exploration* (New York: Norton, 1960); David Livingstone, *The Geographical Tradition: Episodes in the History of a Contested Enterprise* (Cambridge: Blackwell, 1992); Lever H. Trevor, "Vilhjamur Stefansson, the Continental Shelf, and a New Arctic Continent," *British Journal for the History of Science* 21 (1988): 233-247, especially 233-236.

[8] Roald Amundsen, *The North West Passage: being the record of a voyage of exploration of the Ship Gjo 1903-1907*

Amundsen as the fame did little to satisfy his life's true desire, which, ironically, was to discover the North Pole, or to resolve the subsequent controversy which shrouded his achievements.[9] The Northwest Passage was proven to be uneconomical as a trade route to the Far East. Moreover, the "heroic" death by starvation of British explorer Robert Scott in his race with Amundsen to the South Pole eclipsed and tarnished the Norwegian's victory.

Amundsen's dream was dashed in September of 1909 when news reached the outside world of New York physician Dr.

(London: Constable, 1908), 2 vols.; see also, Amundsen, "To the North Magnetic Pole and Through the Northwest Passage," *Geographical Journal* 29, 485-518. For Amundsen's conquest of the South Pole, see Roald Amundsen, *The South Pole,* trans. A.G. Chater (London: John Murray, 1925). For Amundsen's "race" with British explorer Robert Falcon Scott to the South Pole, see for instance, Roland Huntsford, *The Last Place on Earth* (New York: Athenium, 1986). For Scott's Antarctic expedition, see Robert Falcon Scott, *Scott's Last Expedition: being the journals of Captain R.F. Scott, R.N, C.V.O.*, ed. Leonard Huxley (London: Smith, Elder & Co., 1913); Robert Falcon Scott, *Scott's Last Expedition: The Journals* (London: John Murray, 1987). For an interesting self critique of Amundsen's career and telling look into the personality of a much determined explorer, see Roald Amundsen, *My Life as an Explorer* (New York: Doubleday, Page, 1927); and Jennie Boddington, *Antarctic Photographs: Herbert Ponting and Frank Hurley* (New York: St. Martin's Press, 1979).

[9] See, for instance Roland Huntford, *The Last Place on Earth*.

Frederick A. Cook's claim to have discovered the geographic North Pole the previous year. Four days after the world learned of Cook's discovery, fellow American Robert Peary dispatched word from Greenland proclaiming that he had attained the Pole, and claiming his sole and rightful ownership. Peary declared Cook's expedition a fake and supported this with statements from Cook's Eskimo companions. This testimony, given to members of the Peary Arctic Club, revealed that Cook never journeyed far from sight of land.[10] Regardless, Dr. Cook's claim forced Amundsen to revamp his planned North Pole expedition and instead sail to the Antarctic, thereby creating his race for the South Pole against Scott.[11]

---

[10] For a detailed account of Peary's expedition see Robert E. Peary, *The North Pole* (New York: Stokes, 1910). For an analysis of the Cook-Peary North Pole controversy, see for instance William Hunt, *To Stand at the Pole* (New York: Stein and Day, 1981); Hugh Eames, *Winner Lose All: Dr. Cook & the Theft of the North Pole* (Boston: Little, Brown and Company, 1973); Andrew Freeman, *The Case for Dr. Cook* (New York: Coward-McCann, Inc, 1961); Wally Herbert, *The Noose of Laurels* (New York: Atheneum, 1989); Dennis Rawlins: *Peary at the North Pole: Fact of Fiction?* (New York: Robert B. Luce, Inc., 1973); Matthew Henson, *A Negro Explorer at the North Pole* (New York: Stokes, 1912); David Roberts, *Great Exploration Hoaxes* (San Francisco: Sierra Club Books, 1982).

[11] See Frederick A. Cook, *My Attainment of the Pole* (New York: Polar Publishing Co., 1911); Frederick A. Cook, *Return From the Pole* (New York: Pelligrini & Cudhay, 1951).

In the spring of 1909, the two Americans, Cook and Peary, engaged in the first of what would become uncountable claims and counter claims regarding the discovery of the Pole. This war of words was dramatically played out in the pages of the world's largest newspapers. As a result, the actual accomplishment of reaching the Pole was often relegated a secondary story line to the ensuing firestorm of accusations between the two men.[12] Because of disputes like this, polar exploration and geographic conquest during the first two decades of the twentieth century were followed with great interest by the American public which, as historian William Goetzmann points out, "wanted sensation and adventure."[13]

American fascination with unknown and distant lands reflected our nation's character and was a palpable component of the society's framework and structure. As a matter of course and sheer geography, U.S. expansion was directed westward through the heart of the "frontier," supporting Goetzmann's assertion that "America has indeed

---

[12] Beau Riffenburgh, *The Myth of the Explorer: The Press, Sensationalism, and Geographic Discovery* (London: Belhaven Press, 1993), 165-190.
[13] William Goetzmann, *New Lands, New Men: America and the Second Great Age of Discovery* (New York: Viking Penquin Inc., 1987), 433.

been 'exploration's nation.'"[14] As Frederick Jackson Turner noted in 1893, "Up to our own day American history has been in large degree the history of the colonization of the Great West." However, by the 1880's, Turner argues, the western United States had become developed and populated to such a degree that the nation's frontier was no longer clearly discernible. For Turner, this marked the "closing of a great historic movement" which explained and indeed characterized "American Development."[15]

By the turn of the century, American explorers had defined most of the large geographic regions within the nation's domain. These included the magnificent exploring and scientific expeditions of John Wesley Powell along the Colorado River and the scores of Federal survey parties that accomplished their goals of geographic discovery.[16] By the

[14] William Goetzmann, ibid, 5; William Cronon, George Miles, and Jay Gitlin, "Becoming West: Toward a New Meaning for Western History," in Cronon, Miles, and Gitlin, eds., *Under an Open Sky: Rethinking America's Western Past* (New York: W.W. Norton, 1992); Gerald D. Nash, *Creating the West: Historical Interpretations, 1890-1900* (Albuquerque: University of New Mexico Press, 1991).
[15] Frederick Jackson Turner, *The Frontier in American History* (New York: Henry Holt and Company, 1921), 1.
[16] More detailed study and survey of specific geographic regions followed this period of broad geographic discoveries. Moreover, exploration took on a more "scientific" focus. See for instance, Peter Bowler, *The Norton History of The Environmental Sciences* (New York: W.W.

earliest part of the twentieth century the American public had become generally familiar with then current explorations and had developed a taste for fantastic accounts of strange and distant lands within "their" diminishing frontier. U.S. exploration, Goetzmann argues, had "set the values, tone and rhythm of American culture from the eighteenth century to the present."[17] Perhaps this is why the great polar expeditions at the turn of the twentieth century so captured public attention. Indeed, newspapers in the 1880's quickly learned the creative art of selling copy by utilizing their medium to exploit many of the period's more imaginative and controversial explorers.[18]

Norton & Company, 1993), 390. For a history of the United States Geological Society, see Mary C. Rabbitt, *Minerals, Lands, and Geology for the Common Defence and General Welfare*, 3 vols. (Washington, D.C.: Government Printing Office, 1979),

[17] William Goetzmann, *New Lands, New Men: America and the Second Great Age of Discovery*, 4. See Also William Goetzmann, *Exploration and Empire: The Explorer and the Scientist in the Winning of the American West*(New York: Norton, 1978).

[18] Beau Riffenburg, *The Myth of the Explorer*, 119-137. Many explorers during this period were willing and active partners in sensationalism. The promise of patronage carried with it specific expectations and demands and the lure of such financial support often overshadowed any moral reservations the explorer may have had. It should also be noted that the proliferation around the world of geographic societies, whose membership consisted of professional geographers and laymen alike, occurred at about the same time as the American frontier was coming to a close. In

Explorers have long been viewed as heroes and their exploits serve as a means through which common men may experience romantic portrayals of personal sacrifice and national pride. Late nineteenth and early twentieth century explorers reaffirmed America's intent to conquer the natural world and tame the frontier, from which a civilized framework would make possible future development. The explorer represented all that was daring and right in man's perpetual drive to discover, understand and control the unknown.[19]

Some historians have defined three separate and distinct phases of discovery and exploration. However, these

---

1866, 18 geographic societies were in existence. This number reached 137 by 1930. In the United States, the *American Geographical Society* was founded in 1852, the *National Geographic Society* was established in 1888 and the *Association of American Geographers* was founded in 1904. Each of these societies served to disseminate the ever increasing knowledge attained by continued exploration capturing, at least in the United States, a willing market for the more capitalistic minded *National Geographic Magazine*. See, for instance, John K. Wright, "The Field of the Geographical Society," in Griffith Taylor, ed., *Geography in the Twentieth Century: A Study of Growth, Fields, Techniques, Aims and Trends,* (New York: Philosophical Library, 1951), 548-552.

[19] Griffith Taylor, ibid., 1-3. See also Bowler, ibid., 196. On professionalism in the American Context, see Dorothy Ross, *The Origins of American Social Sciences* (New York: Cambridge University Press, 1991).

delineations are made in broad terms and describe significant differences in the way scientific and geographic exploration has been carried out. The First Great Age of Discovery occurred at about the time of the European Renaissance and, as Goetzmann points out, its focus "became that of mapping terrestrial space," in particular, the charting of the world's oceans. Moreover, great surveys were undertaken to identify and document the distribution and composition of the earth's minerals, fossils, flora and fauna.[20]

Throughout the eighteenth and nineteenth century, the Second Great Age of Discovery emerged. It was broadly defined by the geographic exploration of the continents and the formation of partnerships between explorers and academic institutions in field-based scientific investigations.[21] Large-scale expeditions traveled into the hearts of the world's continents, first expanding outside of Europe to Siberia and then, as historian Stephen Pyne notes, across North America "where one of the best known is the trek by Lewis and Clark."[22] Pyne argues that a Third Great Age of

---

[20] William Goetzmann, *New Lands, New Men: America and the Second Great Age of Discovery*, 1-2.
[21] Jules Verne popularized this very notion of exploration.
[22] Stephen J. Pyne, "A Third Great Age of Discovery," in Martin Collins and Sylvia Kraemer, ed., *Space: Discovery and*

Discovery emerged in the mid-twentieth century, solidified by the scientific undertakings of the International Geophysical Year (1957). He suggests that the geographic domain of exploration throughout this period encompasses the solar system, beginning with planet earth.[23]

As the three "Great Ages" of discovery focused on varying geographies, they also employed different modes of exploration. The First Age was characterized by ship-borne exploration while the Second Age utilized a wide array of transportation tools such as canoes, pack animals and spectacular overland treks.[24] In the present Third Age of Discovery, geographic exploration has relied, to a large degree, on remote sensing platforms and satellites, which

---

Exploration (Hong Kong: Hugh Lauter Levin Associates, 1993),38.

[23] Ibid., 25, 34. Indeed, the International Geophysical Year signaled a unique and significant event in global scientific cooperation. IGY included scientists from the former Soviet Union and China. Although Pyne may be correct as to the significance of such an undertaking, it may be argued that the scientific initiatives associated with the Second World War more accurately define the emergence of a Third Great Age of Discovery. See David Devorkin, *Science With Vengeance: How the Military Created the US Space Sciences After World War II* (New York: Springer-Verlag, 1992).

[24] For a review and discussion of the use of ships as a vehicle for scientific discovery, see Richard Sorrenson, "The Ship as Scientific Instrument in the Eighteenth Century," *Osiris* 11, (1996): 221-236.

have allowed for a greater geographic inventory of our planet.

The career of pioneer American explorer Bradford Washburn from 1930-1960 reflects the fundamental goals, structure and geographies of expeditionary science in both the Second and Third Ages of Discovery. Washburn's "inventory" of the mountain landscape has been obtained through the use of similar modes of exploration found throughout these periods. Indeed, Washburn may be viewed as a bridge from the Second era to the present. This dissertation will explore Washburn's career as innovative field scientist, mountaineer, cartographer, photographer and educator in detail. The primary focus will be on the years 1930-1960, as this time frame encompasses the majority of his expeditionary field work in both Alaska and Canada. It is hoped that his career and the themes that emerge from its study will serve as a unique window into broader developments in American science and culture. Since windows provide two-way views, this will also create a context and forum for an analysis of Washburn's many contributions across and within diverse academic disciplines including alpine glaciology, cartography, and photography. This study also addresses Washburn's early and continued utilization of emerging technologies and modes of exploration.

Throughout this work three important themes will emerge to provide the foundation from which Washburn's career may best be understood: Washburn's role as an innovator; geography as a disciplinary bridge; and the work of the independent geographer. First, Washburn's role as an innovative expeditionary scientist will be examined. In this role, he continually utilized an interdisciplinary approach to field-based research and employed the most advanced technologies to support such work.[25] Through dramatic aerial photographs, Washburn's role as vivid "describer" will emerge, framing the geographic landscape in such a way as to capture the dynamic geologic processes at work within the alpine world.[26] "Aerial photography," wrote historian Stephen Pyne

---

[25] By studying the ways in which field scientists conducted such expeditions, we can better understand broader issues such as social stratification, organizational skills and, as Kuklick and Kohler point out, the "heterogeneity of field science workers and tasks." See Henrika Kuklick and Robert Kohler, "Science in the Field," *Osiris* 11, :2-3.

[26] Throughout the history of geographic exploration, explorers and scientists employed numerous mediums to portray and describe the natural world. As Goetzmann argues, expeditionary geographers provided a visual representation of their discoveries and travels, "mapping, describing and characterizing the unexpected that they set out to find." Many explorers took along "artists and illustrators whose visual representations were essential tools for scientific understanding and classification and who generated whole new ways of looking at nature that conditioned scientific thinking." Indeed, Washburn's photographs provided a "whole

in 1979, "has perhaps become the dominant form of geological illustration."[27] The second theme will focus on geography as an integrating discipline. Through Washburn's work we see geography as a bridge for natural and social sciences, a conduit through which multidisciplinary field research is made possible.[28] Indeed, geography and geographic exploration will be seen as a catalyst, motivator and framework for Washburn's expeditionary field work.

The third and final theme highlights and analyzes the role of the independent geographer in the pre and post World War II eras. Although Washburn held a part-time position as instructor at Harvard's Institute of Geographic Exploration (1937-1942), he was, for the most part, an independent geographer and explorer. He relied almost exclusively on his ability to attract financial support from private patrons as

---

new way of looking at nature" and underscored his ability to capture and "describe" the landscape. See William Goetzmann, "Paradigm Lost" in Nathan Reingold, ed., *The Sciences in the American Context: New Perspectives* (Washington, D.C.: Smithsonian Institution Press, 1979), 25.

[27] Stephen Pyne, "From the Grand Canyon to the Marianas Trench: The Earth Sciences After Darwin," in Nathan Reingold, ed., *The Sciences in the American Context: New Perspectives*, 189.

[28] Peter Bowler, *The Environmental Sciences*, 391. For a broader perspective, see Alexander Oleson and John Voss, eds., *The Organization of Knowledge in Modern America, 1860-1920* (Baltimore: The Johns Hopkins University Press, 1979).

well as large corporate entities such as the *National Geographic Society.* As director of Boston's Museum of Science from 1939-1981, he negotiated a contractual agreement with the institution which made possible frequent "paid" expeditionary sabbaticals. Although the Museum covered his salary for such work, it did not provide adequate funding to support large-scale field research. Without the benefit of a permanent university affiliation from which to draw financial backing, he was continually forced to "sell" his ideas and dreams to numerous funding sources. As will be argued, Washburn, the independent geographer, field scientist and entrepreneur, returned enormous aesthetic and scientific dividends to his many investors and countless scientists who continue to benefit from such ventures.[29]

---

[29] Stephan Pyne, "From the Grand Canyon to the Marianas Trench: The Earth Sciences After Darwin," in Nathan Reingold, ed., *The Sciences in the American Context: New Perspectives*, 189. Recent studies in history of science {for instance Robert E. Kohler, *Partners in Science: Foundations and Natural Scientists, 1900-1945* (Chicago: University of Chicago Press, 1991)} have addressed the role of patronage, but have not highlighted the role of individual entrepreneurs; for one exception, see Paul Lucier, "Commercial Interests and Scientific Disinterestedness: Consulting Geologists in Antebellum America," *Isis* 86, 2 (June 1995): 245-267.

These underlying themes will be amplified and analyzed in five chronologically arranged chapters. Chapter One explores Washburn's formative childhood years and the many factors which shaped his life and subsequent career. I will argue that Washburn's parents and family played a critical role in providing the support and opportunity that later became his road map for success. For instance, at the height of the Depression, Washburn was afforded the many benefits of private preparatory schools and a Harvard education. Summer vacations throughout the 1920's to the White Mountains of New Hampshire and the European Alps shaped his interest in and passion for mountaineering, photography, geography, geology and cartography.[30]

Chapter Two discusses the events that lured Washburn from the slopes of Europe to the rugged peaks of Alaska and the Yukon throughout the 1930's. Here, in the glaciated peaks of

---

[30] Washburn's Harvard education, social status, integration of mountaineering and scientific investigations parallels the "gentleman scientists" of the Victorian period such as glaciologists James Forbes and John Tyndall. Indeed, historian Bruce Hevly notes that the Victorians established a link between mountaineering and field science, arguing that "mountaineering should be wed to mountain science." Washburn's field work throughout the 1920's and 1930's reflects a true Victorian framework and style. See Bruce Hevly, "The Heroic Science of Glacier Motion," in *Osiris* 11, 76.

the Wrangell-St. Elias Range, Washburn developed his mountaineering skills and created a framework for Large-scale interdisciplinary field science.[31] Utilizing the airplane for transportation, field supply, photography and aerial reconnaissance, he carried out numerous photographic and cartographic surveys which have become critical in formulating our understanding of the mountain landscape.[32] Private underwriting and personal relationships made Washburn's expeditions possible. The most interesting and perhaps most significant has been his nearly seven decade-long partnership with the *National Geographic Society* -- a most unique and productive relationship.

---

[31] The role and significance of the field scientist/geographer is discussed in Henrika Kuklick and Robert Kohler, "Science in the Field, " *Osiris* 11, 1-14.
[32] The significance of aerial photography in the study of landscape was well appreciated and utilized throughout various regions of Canada beginning in the early 1920's. Indeed, Canadian geophysicist Tuzo Wilson championed the use of such technology, stating that "many features of glacial origin can be recognized and mapped" from the air. See J.T. Wilson, "Structural Features in the Northwest Territories," *American Journal of Science* 239 (1941): 493, John Tuzo Wilson, interview with Ronald Doel, transcribed tape recording, Toronto, Canada, 16 February 1993, 44-45 Niels Bohr Library, American Institute of Physics, College Park, Maryland); J.T. Wilson, "Glacial Geology of Part of North-Western Quebec," *Transactions of The Royal Society of Canada* 32, section IV, (May 1938): 49. See also Morris Zaslow, *Reading the Rocks: The Story of the Geological Survey of Canada 1842-1972* (Toronto: The MacMillan Company of Canada Limited, 1975),372.

Chapter Three deviates somewhat in style and purpose from the other chapters. Here Washburn's role in the research and development of cold weather equipment for the United States Army Air Force during the Second World War is examined. This treatment is important in two ways. First, it provides further insight into Washburn's personality, underscoring his uncanny drive and commitment to a common goal. Draped in confrontation, Washburn's military service is indicative of the style and ferocity he would later exhibit throughout the post-war years to carry out increasingly complex and comprehensive geographic and scientific investigations. Second, field testing in Alaska of military equipment provided many opportunities for Washburn to explore the Mount McKinley region. In the waning days of the war, Washburn was able to carry out a preliminary survey of the McKinley area which he expanded after the war to include a comprehensive survey of the entire mountain - the first such effort to be conducted by an independent geographer.

Chapter Four examines and analyzes Washburn's unique relationship with Mount McKinley that began in 1936 when, at the age of 26, he led an aerial photographic reconnaissance of the peak for the *National Geographic Society*. This work marked the first time the mountain had been systematically photographed, the results of which revealed previously unknown geographic features throughout the McKinley massif. As noted, Washburn's war-time work involved numerous expeditions to the McKinley area, one that included a military test expedition to the slopes of the mountain in 1942. Here, Washburn was afforded the opportunity to climb the peak -- the third such recorded ascent. In 1947 and 1951, with considerable assistance from the U.S. military, and the encouragement of a major American scientist, the Harvard astrophysicist Harlow Shapley, he again scaled the mountain. On each occasion he incorporated an energetic research agenda that included topographic surveying, geological identification and samplings, as well as high altitude geophysical investigation. With the emergence of the Cold War, Washburn capitalized on the military's interest in cosmic ray physics and photogrametry and ways in which they might increase the efficiency of air cargo transport and supply in remote and inhospitable regions. By utilizing the financial and logistical support of several federal agencies, including the Office of Naval Research, Washburn secured sufficient resources to undertake numerous large-scale mapping and mountaineering expeditions to Mount McKinley.[33] It was through such creative support that

[33] Washburn secured funding for his early Mount McKinley surveys in a period that historian Harvey Sapolsky has

Washburn, over the course of fifteen years, obtained a complete survey and photographic record of the peak. From this he produced, in 1960, the authoritative map of the mountain. His intimate knowledge of the peak has made Washburn the unofficial expert on its history, geology, topography, weather and mountaineering routes. He has become McKinley's gatekeeper and a "guide" to thousands of climbers who, each year, rely upon his map, photographs and personal knowledge of the mountain to plan and execute increasingly difficult ascents.

Chapter Five is structured as part conclusion and part epilogue. Here, the numerous themes which emerge from a discussion of Washburn's career will be drawn together and further examined. Washburn's continued use of evolving technologies in subsequent mapping projects such as an extensive survey throughout the 1970's of the Grand Canyon and of Mount Everest in the 1980's will also be examined. Still active today at the age of 87, Washburn increasingly

---

called the "golden age of academic science" in which a steady flow of military funding was supplied to U.S. universities. For a history of the Office of Naval Research, see Harvey Sapolsky, "Academic Science and the Military: The Years Since the Second World War," in Nathan Reingold ed., *The Sciences in the American Context: New Perspective*, 379-399. Sapolsky's reference to the "golden age of academic science" can be found on page 385.

relies upon the world's youngest and brightest scientific minds to assist him in a whirlwind of on-going research programs.[34]

[34] His current project involves the most comprehensive attempt yet made to accurately measure the height of Mount Everest by utilizing the most advanced Global Positioning System (GPS) and laser technologies.

CHAPTER 1

ACQUIRING THE TOOLS OF THE TRADE

THE ROOTS OF DISCOVERY

Henry Bradford Washburn Jr. was born in 1910 - coming into this world in a time when the American frontier had come to a close yet dramatic tales of international exploration and discovery continually fed the public's insatiable desire for epic accounts of geographic conquest and the human drama of Polar "warfare." Growing up in Cambridge, Massachusetts, young Washburn was surrounded by tales of exploration and the lure of distant adventure, an environment which influenced greatly his subsequent interest in exploration. Like many within Cambridge's social elite, the Washburn family followed the unceasing Polar debate between Cook and Peary with great interest. After all, Peary was the "establishment's man," a Naval officer funded and supported by the United States military and the powerful and influential *National Geographic Society.* His public appeal was widespread with name recognition never a problem.

Washburn was only age five when his mother, Edith Washburn, gave him a copy of the book *The Snow Baby*.[35] Written by Josephine Peary, wife of Admiral Robert Peary, the book recounts the birth and early life of the their daughter Mary, the first documented white child born in the Arctic. Washburn and his mother spent hours with the small book which served as an introduction to distant and exotic lands. Washburn's fascination with exploration and his subsequent passion for geographic discovery became entrenched early in his life.

Heroes play significant and influential roles in the development of many youngsters. They find such heroes in the pages of books, on movie screens or in newspapers and magazines and they are often inspired and the course of their lives are often affected. This was the case with Washburn in his formative years. Although his childhood heroes were found within his own family, they had no less profound an impact upon his future development: "My father and mother were, in a way, my first heroes... they took me

[35] Marie Peary, *The Snow Baby* (Cambridge: The University Press, 1901). The book captured Washburn's imagination and is still remembered fondly by him as a significant connection to geographic exploration. Bradford Washburn, interview with Mike Sfraga, unrecorded, Anchorage, Alaska, September 16, 1994.

on my first airplane ride... It was also, unquestionably my mother who opened my eyes to both the fun and importance of photography...."[36]

As we will later see, Washburn recognized the importance of combining his love for flying and photography to create the foundation from which a fruitful career in geographic exploration eventually would emerge. His parents instilled values to which he measured each day's accomplishments. As he later recalled, "My father and mother used to say to me, sort of in unison, 'whatever you do, try to do it well,' and that rubbed off on me."[37] Henry and Edith Washburn gave to their son the most cherished gifts of all: opportunity, support and love.[38] It is clear that Washburn's family played a significant role in the shaping of his career. As we will see, his parents made possible throughout his early

---

[36] Bradford Washburn, "Response by Bradford Washburn" (Speech delivered at the King Albert Memorial Foundation Award Ceremony, St. Moritz, Switzerland., 3 December 1994),2. Similar speeches, correspondence and documents have been received by Mike Sfraga from Bradford Washburn. They will be cited as BWPP (Bradford Washburn Personal Papers). Subsequent to this writing, this material will be added to the Bradford Washburn Collection at the University of Alaska Fairbanks.

[37] A. Botsford, "Catching up with Brad Washburn," *Appalachia* (January/February 1986): 13.

[38] Bradford Washburn, interview with Mike Sfraga, Tape recording, not transcribed, Boston, Massachusetts, July 18, 1992.

years many opportunities to explore and experience the natural world.

Washburn's father Henry Bradford Sr., (for whom he was named) one of seven children, was born in Worcester, Massachusetts, on 2 December 1869 to Mary Elizabeth Whiton and Charles Francis Washburn. He was a direct descendent of William Brewster, signator of the Mayflower Compact and an original settler of the Plymouth Rock Bay colony in 1620, and president of the family's Washburn Wire Company. Therefore, they were a fairly affluent family with a long-standing history in the Boston area. Henry Washburn graduated from Harvard in 1891 and subsequently enrolled in and graduated from the Episcopal Theological School of Cambridge.[39] Encouraged by his parents, Henry pursued advanced theological studies in Oxford and Berlin.[40] Henry's

---

[39] "Life Visits the Mayflower Descendants," *Life Magazine*, 29 November 1948, 132. Bradford Washburn, interview with Mike Sfraga, Boston, Massachusetts, July 1992.
[40] Ibid. Henry followed in the footsteps of his older brother Phillip, a Harvard graduate who pursued Theological studies in Berlin. In 1893 Philip Washburn relocated to Colorado Springs where he led a growing congregation at St. Stephen's until his death at age thirty-seven in 1898. In five short years Phillip Washburn became an important community member and was instrumental in securing additional support for the fledgling Colorado College. See, for instance, George V. Fagen, "Philip Washburn: 'A Thorough Colorado Man'," *The Colorado Magazine*, Fall 1972.

international studies are quite important. While attending the University of Berlin he met Samuel Colgate, a young American theological student and his new bride Edith Hall Colgate.[41] The three became close friends and spent considerable time together. This new friendship affected the lives of both Washburn and Edith Colgate to a far greater extent than the two realized at the time.

Upon completion of his studies in 1896, Washburn returned to the United States where in 1989 he became the Rector at St. Mark's Church in his home town of Worcester, Massachusetts in 1898. He also accepted an appointment to teach at the Episcopal Theological School -- the institution from which he had graduated two years earlier.[42]

---

[41] Samuel Colgate's older brother, Gilbert was President of the family's Colgate Soap Company. Edith Hall also came from a wealthy New England family, her brother, Edward J. Hall developed for AT&T the first long-distance phone service. See, "Western Union Gets Anglo-American," *New York Times*, 17 December 1910, 1; "E.J Hall, Developer of Telephone , Dies," *New York Sun*, 18 September 1914; "Edward J.Hall: vice-president of the American Telephone and Telegraph Co., Died at Watkins, N.Y., September 17, 1914," *The Telephone Review*, October 1914, 279.

[42] Bradford Washburn, "Biographical Summary," unpublished biographical notes, Bradford Washburn Collection, "Biographical Information," Box 1, File 90-072, Alaska and Polar Regions Archives, Elmer E. Rasmuson Library, University of Alaska Fairbanks, Fairbanks, Alaska),2. Unless otherwise indicated, correspondence, diary's and other

By this time the Colgates and their newborn daughter Mabel returned to New York State where Samuel served as Rector for the First Presbyterian Church. Soon after his appointment, he contracted typhoid fever and, after a prolonged battle with the illness, died during the summer of 1902. In the years following Colgate's death, Washburn and Edith Colgate enjoyed an extended yet discrete courtship, building upon their friendship which began in Europe years earlier. The couple married in New York City on 20 May 1908.[43] Shortly after the wedding, Washburn became a professor of church history at the Episcopal Theological School and moved his new family to Cambridge, Massachusetts. On 7 June, 1910, Henry Bradford Washburn Jr. was born and one year later the family expanded to include Bradford's younger brother Sherwood Larned Washburn.

Throughout their sons' early years, the Washburns created an environment in which inquiry and discovery were fostered. They instilled a joy of and passion for the natural world in all three children. In one instance, the boys were introduced to the great mysteries and Pyramids of Egypt, a

---

related material are included in the Bradford Washburn Collection.

[43] Ibid.

subject that fascinated nine year old Bradford and from which his tenacity to learn and inquire soon surfaced.[44] Pursuing this interest, the boys "acquired" a guinea-pig from the Harvard Medical School and, after thorough research, promptly mummified and buried the animal behind the Episcopal Theological School where their father then served as Dean.[45] At the age of ten young Washburn even initiated correspondence with eminent archeologist and family friend Dr. G.A. Reisner at his field camp near Cairo. Learning of camp life in the distant and exotic Egyptian desert whetted Bradford's appetite for adventure and learning, which were enthusiastically encouraged by Dr. Reisner.[46]

In order to keep the family together Henry relocated his wife and children to New York City during the First World War where he served under the Secretary of War for the Commission of Episcopal Churches.[47] Bradford spent a good deal of time fishing from the inner city's piers and subsequently sold his first story for publication at the age of nine entitled "Fishing: What a Boy Thinks." The article,

---

[44] Bradford Washburn to Dr. Jan Fontein, BWPP, 22 June 1983.
[45] Ibid.
[46] Dr. G.A. Reisner to Bradford Washburn, BWPP, 22 April 1920.
[47] Bradford Washburn, "Biographical Summary, " 4.

which brought to light Washburn's early enthusiasm for the detailed explanation of processes, meticulously outlined the most effective means of inner city fishing. The young author instructs the angler to:

> Solder a bell onto the end of a strong piece of wire, on the other end a screw. Fasten this on the dock by means of the screw. Have about a hundred feet of line with about three hooks on the end of the line with a sinker. Tie the loose end of the line to the wire and throw the line into the water. When the fish bite the bell will ring.[48]

The young writer then instructs would-be fishermen to reel the creature in and remove the hook, noting that "they make a little groan and are off to the happy hunting grounds."[49]

Washburn's fascination with the natural world would continue to occupy his interests, extending far beyond urban fishing excursions eventually to include the mountainous regions of New England. After the Washburn's relocated to Boston at the end of the War, two significant episodes uncovered a world of wonder that Washburn found appealing and consuming.

---

[48] Bradford Washburn, "Fishing: What A Boy Thinks," *The Churchman*, 31 May 1919, 12.
[49] Ibid.

A PASSION FOR HEIGHTS

Bradford Washburn's interests in geography and geographic exploration can be traced to two specific events which occurred relatively early in his life. One was the geography lessons of his fifth-grade teacher, Miss Florence Leatherbee, "Every child in Miss Leatherbee's class grew up with an intense interest in the world," Washburn would later note, and a "keen desire to learn by seeing, touching, experiencing."[50]

The second occurred the following summer of 1921 during a family vacation to Squam Lake, where eleven year old Bradford hiked in the purified air of the surrounding hills which presented a "world where there was no hay fever," from which he suffered.[51] Moreover, he discovered the wonderful experience of climbing, underscored by his first ascent of Mount Washington on 21 July, 1921, and reveled in the sheer fun of "hiking on mountain trails and sharing the thrills of discovery with close friends."[52]

---

[50] Bradford Washburn and David Roberts, *Mount McKinley: The Conquest of Denali* (New York, Harry N. Abrams, 1991), 20.
[51] Ibid.
[52] Ibid.

In the years that followed, the Washburns frequented the lakes and mountains of New England where Bradford's uncle Charles, a pioneer in the wire industry, took great interest in both Bradford and his younger brother Sherry, and joined the boys on numerous outings.[53] Long fishing excursions to Maine solidified the uncle's relationship with the boys.[54] When Bradford entered the Massachusetts boarding institution of Groton School, a prestigious, all-boy private school in the fall of 1923, Uncle Charles paid the entire cost of six years tuition -- a gift of "discovery" for his nephew. Charles could well afford the tuition while Henry would have been quite challenged to raise this sum of money.[55]

As we shall soon see, Washburn's Groton years, age 13-18, were quite formative, with several significant experiences serving to shape both his character and future interests. In the summer of 1923 Washburn experienced his first plane ride, a gift from his parents for his thirteenth birthday. The trip fueled his fascination with flying and this attraction would eventually evolve to become the cornerstone

---

[53] Bradford Washburn to Mike Sfraga, BWPP, 15 September 1994. Charles Washburn was a Harvard Graduate and engineer who served as a member of the Massachusetts General Court and later in the United States Congress from 1906-1912.
[54] Henry Washburn to Edith Washburn, BWPP, 22 June 1922.
[55] Bradford Washburn to Mike Sfraga, BWPP, 15 September 1994.

of his lifelong pursuit of geographic knowledge. As Washburn recalls, his mother encouraged him to purchase his first camera, a widely popular Kodak "Vest Pocket Autographic" to record the "details and the highlights of what we see and what we do."[56] No one at the time could realize the significance of the interrelationship of Washburn's interests in flying and photography as they eventually would serve as the catalyst for future accomplishments in aerial photography and mountain exploration.[57]

While attending Groton, Washburn's passion for climbing intensified. Accompanied by his father and brother, the teenager made numerous summer ascents throughout the White Mountains as well as several winter climbs of Mount Washington, one of the most hostile environments found on earth. Washburn used these outings to sharpen his winter photography skills and his ability to endure climbing in adverse conditions.

One particular trip underscored the teenager's skills in winter survival, navigation and ability to remain level-headed in adverse conditions. Washburn would call upon such

---

[56] Ibid.

[57] Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts November 19, 1989. Charles Washburn also served as a Trustee of Groton School.

skills throughout his career. On one particularly eventful winter ascent of Mount Washington, a ferocious storm forced Washburn and classmate Tappy Turner to spend the night stranded in a shelter along the mountain's upper slopes. With the temperature hovering in the teens and wind cutting its way through the walls of the cabin, they chopped wood and stoked the fire to stay warm throughout the night.[58]

The following morning found the boys fatigued from lack of food and rest yet confident of their skills. They even found opportunity to make light of the situation. As Turner noted in the cabin's log:

> 4:04 [a.m.] Have yelled no less than three times at an unresponsive Brad to get him to relieve me... Maybe he has frozen to death - In this event I may have enough breakfast![59]

Washburn and Turner returned safely the next day and although the trip taxed the boys, Washburn focused his attention on developing the winter photographs he had taken. His ingenuity was very apparent at Groton and was not limited to his mountaineering talents. With his love of

---

[58] Bradford Washburn, *Bradford on Mount Washington* (New York, G.P. Putnam's Sons, 1928), 80.
[59] Ibid., 77.

photography ever increasing, Washburn was in need of facilities to develop his growing number of negatives. With no such facility readily available, he had earlier built a makeshift darkroom in the school's basement, satisfying his needs very well.[60] As we shall see in later chapters, Washburn builds a number of "field-based" dark rooms in which expedition photographs are developed for immediate review. With each experience and photograph taken, Washburn slowly and methodically continued to build the skills and techniques, of mountain photography. He reveled in the quality of his pictures and budding knowledge of mountain terrain. Indeed, after one particular climb, Washburn confessed in a letter to his sister Mabel that he knew "more about the trail than the guide did."[61]

Washburn's addiction to climbing, photography and geography blossomed at Groton where such avocations occupied a significant part of his life. Correspondence between the teenager and his older sister reveals the degree to which the mountains of New England consumed his thoughts. His letters included numerous questions regarding the mountains

---

[60] Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, July 18, 1992.
[61] Bradford Washburn to Mabel Washburn, BWPP, ND, December 1924.

and often included detailed hand-drawn "maps" of the terrain for reference in answering his many inquiries:

> How do the mountains look? Is there any snow on Chocorua... Sandwich Dome? (The mountain to the right behind the Squam Range with two poorly defined tops.) Here is the view as you see it with Sandwich underlined.[62]

Washburn worked diligently on his landscape drawings and emerging cartographic skills and subsequently published his first map and guide, *Trails on The Squam Range,* in the Groton School newspaper. He found great satisfaction and enjoyment in producing such maps and shared them most enthusiastically with his friends and family.[63]

Mabel faithfully wrote to her younger brother throughout his Groton years and Washburn kept her up-to-date on his studies, school activities, triumphs and difficulties.[64] Many of his letters reflected an inherent passion for detail, containing such information as the precise time, temperature, precipitation, snow level and weather forecast

---

[62] Bradford Washburn to Mabel Washburn, BWPP, 26 October 1924.
[63] Bradford Washburn to Mabel Washburn, BWPP, ND, March 1925.
[64] Bradford Washburn to Mabel Washburn, BWPP, 15 February 1925.

at the time of writing. This compulsive attention to detail and fascination with the natural world transposed themselves into every facet of Washburn's life and career.[65]

Mabel became a confidant to the teenager and he relied on her for advice and news of home. Washburn even devised a plan to simplify and guarantee a constant flow of letters to and from his sister:

> I have thought over the correspondence idea and have decided that as soon as either of us receives a letter from the other it is his (or her) duty to send one back.[66]

This strong duty to family was no doubt fostered in all the children by Washburn's parents, a family-oriented couple. Mabel did not disappoint her brother and their faithful

---

[65] Washburn's passion for recording weather data can be compared to that of similiar practices during the U.S. colonial period. James Fleming places the history of U.S. meteorology into four distinct categories, the first of which is called the "era of idividual, isolated diarists before 1800" who recorded weather data without the benefit of reliable instrumentation or institutional support. Neverthless, they "contributed to meteorological science by keeping records of the local weather and climate." See James Fleming, *Meteorology in America: 1800-1896* (Baltimore: The Johns Hopkins University Press, 1990), xvii-xviii.
[66] Bradford Washburn to Mabel Washburn, BWPP, ND, 1925.

correspondence and unique relationship continued throughout adulthood.[67]

Groton's curriculum and extracurricular activities challenged Washburn and provided a showcase for his athletic and academic prowess. He played baseball, football and hockey, was a member of the school's wall scaling team, and served as Chairman of the Athletic Association, Captain of the Debate Team and editor of the school newspaper.[68] Washburn's active and physical schedule is indicative, at an early age, of his utter dislike for idle time, whereby each day should yield the most results. His physical skills and talents were matched by his academic abilities. In addition to standard classes in history, mathematics and English, each student was required to study Latin, a subject Washburn did not much care for.[69]

A Mr. Sturgis taught the dreaded Latin class in which Washburn studied. At the beginning of each school year Mr. Sturgis scrambled the boys' last names on the class roster from which the students would be called to recite. Washburn

---

[67] Bradford Washburn to Mabel Washburn, BWPP, ND, 1970.
[68] Groton School, "The Athletic Association," BWPP, 36.
[69] Bradford Washburn, "Groton Memories," (Speech delivered on the occasion of Washburn's Sixty Fifth Groton School class reunion, Groton, Massachusetts., May 1994), 1. BWPP.

and classmate Turner soon figured out the instructor's method of selecting students and prepared more diligently for the days on which they may be called upon. Unbeknownst to the boys, the teacher also re-scrambled the list every six weeks.

Neither Washburn nor Turner had prepared for the day when, to his horror, Washburn was called first to read and translate several lines from Virgil's *Aeneid*. His ingenuity, creativity and showmanship carried him through the crisis. Unable to translate any part of the text, he put heart and soul into the pronunciation and inflexion of each word.[70] After a short time, the teacher stopped the young student, as it was clear that "you understand every word of which you said." Sturgis then called upon Turner to "rise and translate." Washburn received an "A" for his efforts, Tappy Turner received a D.[71] Washburn's daring showmanship would serve him well in years to come as he would address scores of commercial audiences, successfully negotiate with international governments and often rely on his ability to accurately "read a situation" while raising much needed capital to support future expeditions.

---

[70] Ibid., 2.
[71] Bradford Washburn, "Groton Memories," 2.

By 1926, at the age of 16, Bradford Washburn had successfully climbed every peak in the Presidential Range of New Hampshire's White Mountains. Although large numbers of people frequently hiked through the area, Washburn was set to do more than mere hiking. With his acquired knowledge of the area and with no other comprehensive guide to the region available, he authored *The Trails and Peaks of the Presidential Range of the White Mountains.* The guide presented clear and concise trail descriptions and contained his first widely published map, a meticulously hand-drawn work entitled "Trails of Mt. Washington and Near Vicinity."[72] The significance to Washburn of this relatively small map was far reaching, as it signaled a clear and discernible moment when he was able to convey the mountain landscape and the joy of climbing. The importance of this little guide was not lost on Washburn as he declared in "the beginning of a lifelong career of sharing with others."[73]

---

72 Henry Bradford Washburn Jr., *The Trails and Peaks of the Presidential Range of the White Mountains* (Worcester: The Davis Press, 1926).
73 Bradford Washburn, "Biographical Summary," 5.

THE MOUNTAINS TAKE HOLD

Washburn's consuming interest in the mountain world was encouraged by most family members and in 1925, at the age of 15 and still attending Groton School, he received as a Christmas gift from his Uncle Charles a copy of Roger Tissot's classic alpine work *Mont Blanc.* Tissot's book, vividly illustrated with striking photographs of alpine meadows and lofty glaciers, recounted the epic mountaineering history of the mountain and ignited Washburn's interest in Europe's high glacial peaks.[74] However, his interest went far beyond the ordinary mountaineer's vicarious interests in high adventure; the fledgling explorer viewed the Alps as a grand opportunity to hone his photographic skills and techniques as well as exploring the regions glaciers and geology. We will find that Washburn's interest in mountaineering soon would lead him to investigate the region's interesting geologic composition.

Tissot's writings exposed Washburn for the first time to the history of glacier studies and the brilliant scientist and

---

[74] Roger Tissot, *Mont Blanc* (London: The Medici Society Limited, 1924),60. Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, July 18, 1992.

naturalist Horace Benedict de Saussure. Born in Geneva in 1740, de Saussure first saw the Mont Blanc massif during his travels to Chamonix prior to the Napoleonic Wars. The large and dynamic glaciers of the mountain fascinated de Saussure and he longed to study the composition of the ice as well as other facets of the peak's upper realms. Still unclimbed, de Saussure offered a cash reward to the first men who were able to find a practicable route to the mountain's summit.[75] The peak remained unconquered until local doctor Michael Paccard and crystal hunter Jacques Balmat scaled the peak in 1786. With a route to the mountain's summit now defined, de Saussure returned to Chamonix in 1787 with plans to integrate an ambitious scientific research program on his own expedition along the Mont Blanc massif.[76]

Throughout the expedition, de Saussure conducted experiments on the boiling point of water at high altitude, physiological changes related to the effect of altitude on the human body and documented the color of the sky from the summit (which he latter compared with similar observations made in Chamonix). De Saussure continued his work on Mont Blanc the following year with a large contingent of guides

---

[75] Ronald Clark, *The Alps* (New York, Knopf, 1973), 50.
[76] Ibid.

and porters in support of a much expanded scientific expedition.[77]

Tissot's work made such a profound impact on Washburn that he later considered the gift of the book to be one of the most influential events in his life.[78] Indeed, it introduced Washburn to de Saussure's path-breaking work which combined the sport of mountaineering, the art of large scale expedition management and the discipline of scientific investigation. These three facets of de Saussure's work intrigued and inspired Washburn, serving, in part, as a model for his future scientific expeditions.[79] Here again we see the far-reaching effect family members had on his very development, introducing the teenager once more to new and exciting opportunities. De Sausure's work had an immediate impact on the young climber,

---

[77] Ibid., 51, 274. The 1788 expedition was unique in that upon reaching the summit, De Saussure erected a research tent and spent several hours recording temperature, mercurial barometric pressures and conducted other numerous scientific observations. De Saussure's research was the highest recorded mountain investigations at that time.
[78] Bradford Washburn, "Response by Bradford Washburn," 3.
[79] Bradford Washburn, "Bradford Washburn's remarks at the Groupe de Haute Montagne," (Speech delivered to the French Alpine Club, Chamonix, France, February 1995), 2. BWPP.

A lecture presented the previous year at Groton School by Captain John Noel, a member of the 1924 British Mount Everest expedition, also had a profound impact on young Washburn. Noel, the expedition's official photographer, presented the tragic story of this expedition on which George Mallory and Andrew Irvine perished just below Everest's summit.[80] As managing editor of Groton's *Third Form Weekly* newspaper, Washburn reported "a most enjoyable evening," with "vivid pictures of both the beauty and hardship of an Everest expedition."[81] Noel's presentation of daring mountaineering feats and glorious photographs of the Himalayas mesmerized Washburn and further intensified his interest in mountain photography.[82]

By the age of sixteen, Washburn had further defined his keen interest in geography and mountaineering through frequent climbs in both summer and winter months, photographing the landscape at every opportunity. It thus was welcome news to the young would-be explorer that the family would soon visit the mountains of France. In the summer of 1926, Bradford and

---

80 Tom Holzel and Audrey Salkeld, *First on Everest: The Mystery of Mallory and Irvine* (New York: Paragon House Publishers, 1988).
81 Bradford Washburn, "Captain Noel's Lecture," *Third Form Weekly*, BWPP, 9 October 1926.
82 Bradford Washburn, Interview with Mike Sfraga, Anchorage, Alaska, 16 September 1994.

Sherwood accompanied their family to Europe where Henry Washburn, now a professor of church history, was on special sabbatical. The boys spent three glorious weeks in the heart of the French Alps surrounding Chamonix and Zermatt, a focal point of international mountaineering at that time. Under the tutelage of local mountain guides, the Washburn brothers acquired the basics of glacier travel and alpine climbing, transposing and refining the skills they developed in the White Mountains to the ice encrusted slopes of Europe's most challenging peaks.

Subsequently, the boys achieved an impressive list of successful ascents including the Matterhorn (14,690 feet.), Mont Rosa (15,217 feet.) and Mont Blanc (15,780 feet.).[83] Washburn did not miss the opportunity to work on his photographic techniques, and despite the rather limited ability of his small Kodak Pocket Camera to capture the full grandeur of the region, a number of pictures were selected to accompany two climbing articles he authored for *The Youth's Companion*.[84]

---

[83]Bradford Washburn, "Europe and the Alps," D, 24 June-4 September 1926. Box 1, 92-147.

[84] Bradford Washburn, "A Boy on the Matterhorn," *The Youth's Companion*, 17 March 1927,190; Bradford Washburn, "I Climb Mont Blanc," *The Youth's Companion,* 30 June 1927.

Washburn's stories and photographs captured the attention of American publishing tycoon George Putnam, founder of G.P. Putnam and Sons, who considered such mountaineering stories a perfect fit for his newly created series Boys Books for Boys.[85] Prior to his second visit to Europe in the summer of 1927, the seventeen year old met with Putnam in New York to solidify plans for a book chronicling his forthcoming mountaineering adventures. Putnam's excitement for the project was evident as he ordered two hundred thousand advertising sheets to support future sales.[86] Later that summer, the Washburn brothers spent two months in Chamonix during which time they again conquered Mont Blanc and completed a number of other difficult climbs, including a traverse of the rather difficult Grand Charmoz and Grepon. Washburn's boundless energy carried over from the successful climbing season, taking less than two weeks to complete the manuscript for his first of three books for Putnam's series entitled *Among the Alps with Bradford.*[87]

The Washburn brothers returned to the Alps in the summers of 1929 and 1931 to continue their apprenticeship under the

---

[85] Edith Washburn to Mabel Washburn, BWPP, 29 May 1927.
[86] Ibid.
[87] Bradford Washburn, *Among the Alps with Bradford* (New York: G.P. Putnam's Sons, 1927). *Bradford on Mt. Washington*

famous French alpine guides Alfred Couttet, Georges Charlet and Antoine Ravanei. During this time Washburn made numerous ascents of Mont Blanc and a number of impressive climbs including the "course classic" - Charmoz-Grepon, the traverse of the Drus, the first ascent of the arete des Rochassiers and the second ascent of the Col des Deux Aigles.[88] All highly challenging climbs, even by today's standards.

Of Bradford Washburn's numerous mountaineering accomplishments, the first ascent of the "impossible" north face of the Aiguille Verte (13,520 feet) in 1929, at the age of nineteen and soon to enroll at Harvard College, is considered an alpine classic and one of his most celebrated mountaineering accomplishments. What makes this climb so impressive is that it traversed mixed rock and ice at a sustained angle of over sixty degrees; yet the endeavor took a mere four hours and twenty minutes to complete from base camp to summit.[89] Washburn's accomplishments were

---

was published in 1928 and the final book in the series, *Bradford on Mt. Fairweather* was published in 1931.

[88] Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, July 18, 1992.

[89] Bradford Washburn, "The First Ascent," *The Sportsman*, March 1930, 102. For a brief, contemporary review of Washburn's European ascents, including the Aiguille Verte, see, *High Magazine Sports*, "Alpine Special," February, 1995, 53.

acknowledged that same summer by France's elite alpinists as the young American was elected to membership of the Groupe de Haute Montagne of the prestigious Alpine Club of France.

Washburn continually improved his photographic skills by taking hundreds of pictures in various types of terrain and weather conditions. Once again, the valuable influence of his mother played a major role in his development when she convinced her son that, although his pictures were of good quality, they were too small to capture the true aesthetic value of the region. Therefore, Washburn retired his "Vest Camera" and used the proceeds of his book and magazine sales to purchase the superior 4"X 6" "Ica Trix" camera. which enabled him to take large format photographs of large subject matter, enhancing significantly the quality of his work.[90]

Washburn's career experienced a dramatic turn when he came under the tutelage of Chamonix photographer and film maker Georges Tairraz. With Tairraz's assistance, Washburn filmed and directed his first 16mm movie during a traverse of the

---

[90] Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, July 18, 1992.

Grands Charmos and Grepon.[91] Although pleased with the film's climbing content, Washburn believed a sequence of aerial photographs of the region "would help give scale and dimension" to mountain terrain and more effectively relate the region's topography "than ground photographs from any conceivable location."[92]

Renowned French pilot Thoret was hired by Washburn for the experiment. At the small aerodome La Fayat, the two men boarded Thoret's monoplane in which they circled high above the great peaks of Europe. Perched in the open air cockpit high above Chamonix, Washburn snapped his first aerial photographs and, by doing so, effected one of the earliest aerial surveys of the region.[93] The powerful tool of aerial photography for the investigation of landscape and route finding was not lost on Washburn. From this time forward he focused his efforts on capturing from the air detailed geographic and geologic features of the world's mountainous regions.[94] He also continued his work in the production of motion pictures, co-producing with George Tarraiz the first

---

[91] Bradford Washburn, "Aerial Photography: Alaska and the Alps," *The Mountain World* (Chicago: Rand McNally & Company, 1961), 19.
[92] Ibid.
[93] Ibid.
[94] Bradford Washburn to Mike Sfraga, BWPP, 21 February 1995.

complete and commercially viable mountaineering motion picture of a traverse of the Grepon. Washburn would later use this film in public lectures during his Harvard years to supplement his income.

By modern standards, Washburn's climbing and photographic equipment as well as Thoret's tiny monoplane would be considered rather crude tools of the trade. Nevertheless, their flight was one of just a few that ushered in a new and dynamic era of aerial photography and contributed to the practicability of the emerging field of photogrametry.[95] As Washburn notes, the experience crystallized his passions and became the foundation for his novel career in the "study of mountains, glaciers and geomorphology from the air."[96] He realized that aerial photography not only advanced the cause of the geographer and geologist, it also provided a detailed, literal description of the mountain terrain which could serve as an invaluable source of information for any mountaineer. Subsequently, Washburn employed aerial photography and reconnaissance on nearly every expedition in which he participated.

---

[95] Ibid.
[96] Ibid.

Following his European climbing accomplishments, Bradford Washburn followed a long standing family tradition and enrolled at Harvard College, selecting a course of study in French History and Literature, a considerable deviation from other more obvious choices. One might suspect that he may have chosen to study in the sciences, particularly geology. As he would later note, Washburn felt his selection a consistent with his belief that you must pursue those endeavors which make you most happy.[97] While at Harvard, he began a busy schedule of public lectures profusely illustrated with his own stock of climbing photographs and movie footage, the proceeds from which served to augment his college and living expenses and provided also a source of funding for future expeditions. The speaking circuit, which he enjoyed immensely, expanded rapidly, and in 1930, he lectured with acclaimed outdoor photographer Burton Holmes at many notable forums including those held at New York's Carnegie Hall, Symphony Hall in Boston and Chicago's Orchestra Hall.[98]

Speaking in such prominent venues reserved for the social and political elite proved to be another first for Washburn

---

[97] Bradford Washburn, interview with Mike Sfraga, Tape recording, Cambridge, Massachusetts, 23 July, 1992.
[98] Bradford Washburn, "Biographical Summary," 7.

and the mountaineering community as a whole. Although such "performances" have become a financial mainstay for many of today's great mountaineers and outdoor photographers, it was Washburn who forged the path in which others have followed. In doing so, he secured a place as one of America's first professional mountaineers.

At the age of twenty, the Harvard student had amassed an impressive list of credits including numerous first ascents, the production of a number of maps, articles and books, an impressive portfolio of mountain photographs and a thriving lecture circuit. It is little wonder that such accomplishments caught the attention of *National Geographic Society* President Gilbert Grosevnor. In 1930, Grosvenor invited Washburn to present a lecture at one of the Society's official speakers program, joining a distinguished list of presenters including polar explorers Captain Robert A. Bartlett, Sir Wilfred Grenfell, Rear Admiral Richard E. Byrd and Dr. Laurence Gould.[99] Washburn's lecture, entitled *"Reading a New Trail to Green Needle's Tip,"* illustrated with his private stock of photographs, impressed the audience of seasoned explorers as well as the Society's

---

[99] National Geographic Society Memorandum, BWPP, undated, 1930.

president.[100] Grosvenor became an instant fan of the young mountaineer and sparked a rather unique relationship between Washburn and the Society which spanned nearly seven decades.[101]

Bradford Washburn's mountaineering and photographic apprenticeship which began in the White Mountains of the United States at age eleven, now came to a close on the icy slopes of Europe's tallest mountains. His climbing techniques, honed under the watchful guidance of the world's foremost mountain guides afforded him the skills needed to confidently traverse high alpine glaciers, and to tolerate frigid temperatures and rugged terrain. Washburn's skills as a mountain photographer also evolved, utilizing large format cameras and incorporating the airplane to capture the aesthetic, geologic and geographic features of the mountain landscape. In 1929, at the strikingly young age 29, Washburn emerged as one of America's most experienced and promising mountaineers and outdoor photographers.

---

[100] Bradford Washburn, interview with Mike Sfraga, Tape recorded, Boston, 18 July, 1992. Gilbert M. Grosvenor, transcribed speech given in honor of The Alexander Graham Bell Medal of the *National Geographic Society*, BWPP, 6 November 1980.

[101] At this writing, the relationship between Bradford Washburn and the *Society* continues.

In the summer of 1930, with the promise of bold adventure and new horizons, the Harvard student turned his ambitions, expertise and boundless energy to the glacial-clad mountains, unknown landscapes and unexplored regions of Alaska and Canada. Here, he envisioned numerous opportunities to test his mountaineering and cartographic skills in a country whose unknown landscape far exceeded that which had been discovered. To Washburn, mapping, photographing and exploring the landscape soon would turn from avocation to profession and become the passion and driving force of his life's work.

Washburn's exploration into the remote regions of Southeast Alaska and the Yukon will be the subject of the following chapter. Here we will see Washburn transpose the mountaineering, photographic and organizational skills and abilities he acquired in the White Mountains and Europe to effectively lead numerous scientific and geographic expeditions to this remote region of North America. By the late 1930's a distinct and effective model would emerge for the planning and execution of large-scale interdisciplinary field-based science and geographic expeditions.

Chapter 2

"A BIG CHANCE FOR EXPLORATION"

THE PATHFINDERS

By the summer of 1930 Bradford Washburn had completed his first year as a Harvard undergraduate and was preparing for his first of many Alaskan expeditions. In order to fully appreciate the context for and accomplishments of Washburn's scientific and geographic exploration throughout Alaska and Canada, which constitutes the goal of this chapter, a description of the landscape and discussion of several pertinent exploring expeditions prior to Washburn's work in this region is warranted.

The mountains of Southeast Alaska, British Columbia and Yukon Territory in Canada rise dramatically from sea level to heights in excess of 19,000 feet. Powerful tides, dense forests and the largest concentration of glacial ice outside of the polar ice caps serve as a natural barrier to the vast alpine system which extends inland for hundreds of miles.[1] Nearly 40,000 square miles of this region is covered by glacial ice.[2] The mountains of Southeast Alaska are placed into three distinct networks comprising the Coast Mountains, Saint Elias and Wrangell Mountain complexes.

The Wrangell Mountains span 100 miles in length and 60 miles in width and are located between the Chitna River in the south, Nabesna in the north and the Saint Elias Range and Copper River in the east and west respectively. Several large peaks reside in this volcanic range including Mount Blackburn (16,390 feet), Mount Sanford (16,237 feet) and Mount Wrangell (14,163 feet).[3]

The glaciers of the Coast Mountains compose one of North America's most extensive mountain networks and transcend the

---

[1] Robert Sharp, *Living Ice: Understanding Glaciers and Glaciation* (New York: Cambridge University Press, 1992), 49; William Field, *Mountain Glaciers of the Northern Hemisphere* (Hanover: Cold Regions Research and Engineering Laboratory, 1975), 4.

[2] Glaciation throughout Alaska has been primarily alpine in nature. See, Thomas D. Hamilton, Katherine M. Reed, Robert M Thorson, eds., *Glaciation in Alaska: The Geologic Record* (Anchorage: Alaska Geographic Society, 1986), 2. William Field, *Mountain Glaciation of the Northern Hemisphere*, vol. 2 (Hanover: CRREL, 1975), 4.

[3] Robert A. Henning, Barbara Olds, and Penny Rennick., *Alaska's Glaciers* (Anchorage: Alaska Geographical Society, 1982), 89.

Alaskan boundary with British Columbia and the Yukon Territory.[4] The glaciers in this region cover an area from the Canadian border in the south to the Fairweather Range in the north. The Juneau and Stikine Icefields comprise the majority of ice within this complex and cover an area in excess of 2,500 square miles.[5] The Saint Elias Mountains run adjacent to the Coast Mountains, extending 300 miles in length and 90 miles in width along the Alaska-Canadian border. This area is defined on the southeast from Cross Sound, Icy Strait and Lynn Canal northward to the Bering and Taku Glaciers and terminates at the White River.[6]

Within the Saint Elias Mountains lies the Fairweather Range, stretching northward from Cross Sound in the Gulf of Alaska to the Alsek River. Hundreds of glaciers flow from the heart of this range where mountains rise from sea level more dramatically than that of any other mountain system on earth. Here, peaks soar above 10,000 feet and in some instances elevations are gained within a few miles of the coast. The principal peaks of the Fairweather range include Mount Root (12,860 feet), Mount Crillon (12,726 feet), Mount

[4] William O. Field, *Geographic Study of Mountain Glaciation in the Northern Hemisphere* (New York: American Geographical Society, 1958), 2.a.1.3.
[5] Henning, *Alaska's Glaciers*, 64.
[6] Ibid., 76.

Watson (12,516 feet) and its monarch and namesake, Mount Fairweather (15,300 feet).[7]

The mainland of Alaska remained undiscovered and much coveted by the outside world well into the eighteenth century. However in 1741, Vitus Bering, in command of Russia's Great Northern Expedition, sailed southeasterly from Kamchatka around the Aleutian Islands. He then sailed northeast and anchored off Alaska's southeast Panhandle. From this vantage point the expedition noted a massive snowclad mountain towering high above the shore which Bering named Mount St. Elias, in honor of the feast day of St. Elias on the Orthodox Church calendar.[8]

---

[7] Ibid., 77.

[8] Stephan P. Krashieninnikov, *Explorations of Kamchatka: 1735-41* (Portland: Oregon Historical Society, 1972), 121. There is some confusion as to whether Bering intended to name the mountain or the cape nearest his anchorage - Cape Elila. See Sven Waxell, *The American Expedition* (London: William Hodge and Company, 1952), 105. Historian Bill Hunt believes cartographers transposed Bering's intended Cape Elila to St. Elias, the largest peak on the expedition's exploratory maps: "It remains customary to credit Bering with naming the mountain even though the evidence does not confirm it." See William Hunt, *Mountain Wilderness* (Washington, D.C.: Government Printing Office, 1991), 13. A few days prior to Bering's Discovery, Chirikof had sighted Prince of Wales Island in the Alexander Archipelago. See William Hunt, *Mountain Wilderness*, 7.

Expedition scientist and naturalist George Steller was permitted a mere five hours on nearby Kayak Island to collect specimens of both fauna and flora. He discovered signs of the much coveted sea otter and made the first ethnographic studies in the region. George Steller's scientific work signaled the first systematic investigation of the region's resources.[9]

Bering's discovery enticed further exploration and can be viewed as the catalyst for all subsequent geographic exploration in the region. Celebrated British Captain James Cook explored Alaska's coastline during his voyage of the Pacific in 1778 and documented the existence of an entire network of towering mountains which he named the Fairweather Range. Less than a decade later French explorer La Perouse, in search of the Northwest Passage, surveyed the waters and coastal areas of Yakatat Bay and later discovered Lituya Bay.[10] In 1787 English explorer George Dixon carried out the first systematic surveys in this region and subsequently produced the first map of Yakatat Bay.[11]

---

[9] George Wilhelm Steller, *Journal of a Voyage with Bering 1741-1742* (Palo Alto: Stanford University Press, 1988), 65.
[10] Jean Francois de Galaup, Comte de La Perouse, *A Voyage Around the World, vol. 1* (London: Joseph Bumstead, 1799), pg. 364-416
[11] Israel Russell, "An Expedition to Mount St. Elias, Alaska," *National Geographic Magazine*, 29 May 1891, 63-64.

Dixon's work in the vicinity of Yakatat Bay was followed in 1792 by that of Alejandro Malaspina, an Italian in the service of Spain, who effected a more accurate location and survey of the bay, and secured a preliminary elevation for Mount St. Elias. The Spaniards believed the then undiscovered link from the Pacific to the Atlantic, the "Strait of Annan," lay in the immediate vicinity of Yakatat Bay.[12] Upon further investigation, Malaspina discovered the bay to extend further inland than previously believed, yet his work was abruptly halted as the waters terminated in an immense network of ice composed of what today are referred to as the Hubbard, Turner, and Miller glaciers.[13] Leaving an indelible footnote to the reality of false hope, he named the area "Disenchantment Bay."[14]

Captain George Vancouver's Northwest Passage expedition of 1794 carried out the most extensive survey of Southeast Alaska to that time. In doing so, Vancouver found no evidence of the Passage and so had "removed every doubt, and set aside every opinion of a north-west passage...."[15]

---

[12] Ibid., 63.
[13] Ibid.
[14] Ibid.
[15] George Vancouver, *A Voyage of Discovery to the North Pacific Ocean*, (London: Hakluyt Society, 1801), 1552.

It is interesting to note that early exploration (and significant geographic discovery) of this region, similar to that of the eastern Canadian Arctic, found much of its impetus from nationalistic determination to discover and subsequently exploit the Northwest Passage for economic and political gain.[16]

Numerous expeditions were dispatched to Southeast Alaska throughout the nineteenth century and of particular note is that of the United States Coast Survey in the summer of 1874. Under the auspices of William Dall and Marcus Baker, the expedition was charged with a detailed survey along Alaska's coast to include Yakatat Bay. Dall carried out many observations of the area's geology and glaciers and recalculated the height of Mt. St. Elias to be 19,500 feet, over one thousand feet higher than today's accepted height.[17] A subsequent triangulation completed by the Coast and Geodetic Survey found the correct height of St. Elias to

---

[16] Pierre Berton, *The Arctic Grail: The Quest for the North West Passage and the North Pole* (New York: Penguin Group, 1988), 16-17.
[17] William H. Dall, "Report on Mount Saint Elias, Mount Fairweather, and Some of the Adjacent Mountains," *USCS Annual Report*, 1875, 159.

be 18,100 feet and set Canada's Mt. Logan to be higher than 19,000 feet.[18]

Naturalist John Muir explored the glaciers of Southeast Alaska with Presbyterian minister S. Hall Young in the summer of 1879. On this and subsequent visits Muir was overwhelmed by Alaska's natural beauty and penned numerous popular accounts in flowing prose, painting for the reader a world of striking splendor and boundless wilderness. His romantic language and love of the wild came at a time when nineteenth century American expansion and frontierism was waning throughout the American West. For the armchair explorer and would-be adventure traveler, Muir offered images of a vast land undiscovered, wild and untainted, every bit as raw as the Wild West of days gone by. Muir had eloquently and poetically portrayed yet another rugged "American landscape," and in the process, created a scientific and economic pathway to extend American "Manifest Destiny" to this relatively unknown region.[19]

Although Lieutenant C.E.S. Wood discovered Glacier Bay in 1877, Muir popularized the bay through his writings, mapping

---

[18] Morgan Sherwood, *Exploration of Alaska: 1865-1900* (Fairbanks: University of Alaska Press, 1993), 81; see also, "Note on Mount Logan," *American Geologist* 13 (1894): 292.
[19] Morgan Sherwood, *Exploration of Alaska: 1865-1900*, 75.

and detailing the region's magnificent landscape and glaciers. Although not the only factor, Muir's writings encouraged cruise ship excursions to Glacier Bay and surrounding areas by 1883, luring both tourist and scientist into the heartland of Alaska's glaciers. The number of scientific investigations increased dramatically in the coming years as tourism and science formed a unique partnership in one of the grandest glacial laboratories on earth. Indeed, Muir's powerful observational skills were surpassed only by his ability to articulate the natural landscape and such ability, when viewed in the context of scientific endeavor, was path-breaking for the time. This "inductive method," which came easily to Muir when applied to geologic inquiry, had by this time, become a fundamental component of scientific investigation.[20] While in Yosemite, Muir had recognized and understood the vital role glaciers had played in the formation of the valley, and thus became fascinated with their role in shaping the mountain landscape.[21] Muir formulated numerous theories regarding glacial behavior and characteristics, utilizing his Alaskan travels to document the very dynamics he suspected were responsible for the formation of the Yosemite Valley.[22] When

---

[20] John Buwalda in William E. Colby ed., *John Muir's Studies in the Sierra* (San Francisco: Sierra Club, 1960), ix.
[21] Ibid., xxv.
[22] Ibid., 17-74.

viewed in the larger context of field geology, Muir's observational skills and theoretical summations he set forth in numerous scientific writings, spurred significant glacial research in Alaska throughout the closing decades of the nineteenth century.[23] "John Muir's greatest contribution," explains historian Morgan Sherwood, "was the publicity he gave to the Far Northwest as a field for scientific and aesthetic investigation."[24]

Yet Muir's work was not the sole catalyst for such exploration. In the late nineteenth century, the United States government (most notably the Army and United States Geologic Survey, founded in 1879) began a somewhat concerted and systematic survey of Alaska's resources. These efforts were, in part, fueled by growing interest in Alaska's mineral wealth, geography, geology and the emerging discipline of glaciology.[25]

William Blake conducted the first extensive scientific study of Alaska's glaciers along the Stikine River in 1863, nearly three decades after similar investigations had begun in

---

[23] For an account of Muir's observations in Alaska see, *John Muir: Travels in Alaska* (Boston: Houghton Mifflin Company, 1979.

[24] Morgan Sherwood, *Exploration of Alaska: 1865-1900*, 76.

[25] Ibid., 36.

Europe (circa 1830's).[26] G. Frederick Wright explored and studied Glacier Bay in 1886 and was followed by two expeditions under the auspices of Professor Harry Reid to the region in 1890 and 1892.[27] Reid was joined by a complement of students from Cleveland's Case School of Applied Science who concerned themselves with motion study of Muir Glacier. He employed the most modern scientific and photographic equipment available and set the standard and practice for further research into the mechanics of glacial flow and behavior.[28]

---

[26] William P. Blake, "The Glaciers of Alaska, Russian America," *American Journal of Science,* 2nd. series, 44 (1867): 96-102; Israel Russell, *Glaciers of North America* (Boston: Ginn & Company, 1897), 75. For the emergence of glacial studies in Europe, see Gerald Seligman, "Research on Glacier Flow," *Geografiska Annaler* no. 1-2 (1949):228-238. In Europe during the late 1860's, glaciers began a dramatic recession after decades of widespread surges which threatened water supplies and led to systematic widespread surveys. See F.E. Mathis, "Glaciers," in *Hydrology, Physics, of the Earth* - IX (New York: Dover, 1942.), 149-219.

[27] Frederick G. Wright, "The Muir Glacier," *American Journal of Science* Series 3,33 (1887): 1-18.

[28] Harry Fielding Read, "Studies of Muir Glacier, Alaska," *National Geographic Magazine,* 21 March, 1892, 19-84. Reid was interested in defining ice behavior and flow mechanics. See also, W.O. Field, "Glaciological Research in Alaska," in Henry B. Collins, *Science in Alaska* (Washington: The Arctic Institute of North America, 1952), 124; Field contends that glaciology "attained the status of an independent earth science" prior to the second World War; William Field, *Some Aspects of Glaciers and Glaciology* (Washington, D.C.: Naval Operations for Polar Projects, 1956), 3; see also Hans Wilson Ahlmann, "Forward," *Journal of Glaciology,* 1 (1947):

While Reid investigated Glacier Bay, geologist Israel Russell led two survey and scientific expeditions to the Mount St. Elias region in 1890 and 1891, under the auspices of the fledgling National Geographic Society and the United States Geological Survey (USGS). Russell was to give "special attention" to the distribution of glaciers and compile information "with reference to the age of the formations... and the type of structure of the range."[29] Moreover, the Society charged Russell with a reconnaissance of as large an area as possible (from which he was to prepare a map of the region and attempt an ascent of Mount St. Elias), the result of which encompassed an area in excess of one thousand miles.[30] Although Russell failed to reach the mountain's summit, he did establish a base line survey of the peak (elevation 18,100 feet) and obtained substantial glacial observations, ground based photographs

---

3-4. There are few works available which discuss the history of glaciology. A recent work by Bruce Hevly's is a positive step in addressing some very important issues regarding the development of this field. See, Bruce Hevly, "The Heroic Science of Glacier Motion," *Osiris*, 11, (1996): 66-86.

[29] Israel Russell, "An Expedition to Mount St. Elias, Alaska," National Geographic Magazine, 29 May, 1891, 192. This was the first field expedition sponsored by the National Geographic Society, see C.D.B. Bryan, *The National Geographic Society: 100 Years of Adventure and Discovery* (New York: Harry N. Abrams, 1987), 31.

[30] Ibid., 194.

and surveys, and a detailed description of the Malaspina's unique characteristics as well as those of the Hubbard Glacier. Russell's data would serve as bench-mark information from which subsequent observations were to be compared.

Prior to the end of the nineteenth century, two noteworthy private expeditions also explored this region. In 1897, the Duke of Abruzzi's expedition (which made the first ascent of St. Elias) traversed and documented the Malaspina's interesting composition and speculated as to its source.[31] Later, in 1899, millionaire industrialist Edward H. Harriman privately financed the Harriman-Alaska Expedition, for which he secured the services of leading scientists and naturalists such as William Dall, Henry Gannett of the USGS and John Muir, from varying disciplines of study such as botany and geography. Thus, Harriman created a floating scientific laboratory, the accomplishments of which included a detailed photographic record and survey of the termini of nearly two dozen glaciers along Alaska's southeast coast. The expedition's contribution to science cannot be overstated. Harriman had created a truly unique core of some of the country's brightest scientists in a way which had not

[31] Filippi de Filipo, *The Ascent of Mount St. Elias*, (Westminster: Archibald Constable, 1900), 79.

been done before and which resulted in an "interdisciplinary institute" dedicating its attention to one very specific region. Information attained by the expedition proves invaluable to further scientific investigation in that it provides a basis for subsequent research in areas such as climate studies, glaciology and related fields.[32]

PERSISTENCE ABOUNDS

By 1900, the general features and location of most Alaskan glaciers were known. The vigor of glacial exploration in Southeast Alaska and Canada diminished after the first decade of the twentieth century, leaving few to continue the work begun so auspiciously and with the attention of so many. The void was somewhat filled by scientists Ralph Stockman Tarr and Lawrence Martin who conducted extensive glacial surveys along Alaska's Panhandle from 1904 through 1914. Their research encompassed a broad geographic region from Prince William Sound to Yakatat Bay, Valdez and

---

[32] C. Hart Merriam, ed., *Harriman Alaska Expedition*, 13 Vols. (Washington, D.C.: Smithsonian Institution, 1901 - 1914); for a review of the expeditions glacial surveys, see Grove Karl Gilbert *Glaciers and Glaciation* (Washington D.C.: Smithsonian Institution, 1910); for the significance of the expedition's results, see William O. Field, "Glaciological Research in Alaska," 125. See also, William H. Goetzman and Kay Sloan, *Looking Far North: The Harriman Expedition to Alaska, 1899* (Princeton: Princeton University Press, 1982).

Cordova. In the years 1909-11 and 1913, the two scientists, under the auspices of the National Geographic Society, concentrated their efforts in the Yakatat Bay and Prince William Sound region. Their findings, which included photographs and detailed survey data of the region's glaciers, were published in the classic text *Alaskan Glacier Studies*, a benchmark turn-of-the-century resource.[33]

In 1926 William Field received a B.S. in Geology from Harvard College and subsequently organized a preliminary photographic and survey expedition to Southeast Alaska, in particular, Glacier Bay and Lituya Bay, about which he recorded conditions and the termini of numerous glaciers.[34] This and subsequent research by Field in Alaska was a bridge from the pioneering work of the late nineteenth and early twentieth century scientists and an emerging cadre of young and eager novice exploratory scientists. Upon his return to Harvard several years later, Field presented a lecture on his Alaskan explorations, accompanied by vivid photographs, to faculty and students. In attendance that evening was Bradford Washburn, a Harvard undergraduate, who found

---

[33] Ralph Stockman Tarr and Lawrence Martin, *Alaskan Glacier Studies* (Washington: National Geographic Society, 1914), ix-x.
[34] William Field, "The Fairweather Range: Mountaineering and Glacier Studies," *Appalachia*, December 1926, 460-472;

himself absorbed by the mountain scenery and vast unknown regions of the North. By the close of the presentation, Washburn was convinced of Alaska's enormous opportunity for geologic and geographic exploration.[35] This lecture sparked Washburn's interest in Southeast Alaska and would drive his desire to explore this region in the years to follow. Field had provided a bridge from those pioneers of the late nineteenth century to a new generation of Alaskan scientific explorers, and Washburn was eager to forge ahead.

In January of 1930 Bradford Washburn discussed opportunities for exploration and mountaineering in Alaska with his Cambridge friend, Bob Morgan. The two reviewed the mountaineering article of the heroic, but failed, 1926 attempt to climb Alaska's Mount Fairweather (the tallest unclimbed mountain in North America). Morgan was an accomplished mountaineer and part of the team that made the first ascent in 1925 of Canada's Mount Logan. As the discussion continued, Washburn became more intrigued with the apparent opportunities in the Fairweather region for

[35] Bradford Washburn, interview with Mike Sfraga, Tape recording, Cambridge, Massachusetts, 23 June, 1992. Present that evening with Washburn was fellow Harvard student Terris Moore, later to become the second president of the University of Alaska - 1947-51. Moore credits Field with enticing him to climb in the then virgin peaks of Southeast Alaska. Terris Moore, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, 25 January 1993.

geological and mountaineering exploration. The memory of Field's mesmerizing Alaskan photographs and the lure of the continent's tallest unclimbed mountain consumed Washburn's thoughts and set his imagination aflame.[36]

While climbing throughout the European Alps in the late 1920's, Washburn had acquired an appreciation for and fascination with high alpine mountains. The possibility of exploring a vast region -- relatively unknown, unstudied, unphotographed was far too enticing for him to ignore. After careful review, he declared there to be a "big chance for exploration still open in the Fairweather Range."[37] This romantic idea consumed the thoughts of the young Harvard student and, "having nothing better to do," Washburn spent many "enjoyable February evenings" counting up "probable costs of a trip to Alaska and listing foods and equipment."[38] In specific terms, this describes the way in which Washburn became enthralled by geographic and scientific discovery in Alaska. In general terms, it could well

---

[36] Mount St. Elias, 18,008 was climbed in 1897; see Filippi de Filipo, *The Ascent of Mount St. Elias*.. Mount McKinley was scaled in 1913; see Hudson Stuck, *The Ascent of Denali* (Lincoln: University of Nebraska Press, 1989.
[37] Bradford Washburn, *Bradford on Mount Fairweather* (New York: G.P Putnam's Sons, 1930), 7.
[38] Ibid.

portray the way in which many geologists and glacioligists have moved into their particular field. The landscape provides the lure and questions yet to be answered regarding the natural world become the legitimate reason for investigation. The far north that William Field had introduced to Washburn just a few years before would now provide a relatively clean page on which he could explore and fill in the unknown.

Preliminary plans during the winter of 1929-30 progressed so well that Washburn quickly recruited six Harvard classmates to comprise what became known as the Harvard-Mount Fairweather Expedition.[39] Washburn planned carefully and purposefully for his first foray onto Alaska's rugged peaks. He was cognizant of the fact that many remote expeditions in this era of exploration experienced problems with food preparation, distribution and transportation. He was adamant that such logistical hurdles be eliminated "so that if we were beaten it would be by the mountain and not by our own under preparedness."[40] This point vividly illustrates, at the age of 20, Washburn's maturity and leadership abilities. From this philosophy emerged the Washburn "food bag system" of preparation whereby each day's food for the entire team

---

[39] Ibid.

[40] Bradford Washburn, *Bradford on Mount Fairweather*, 9.

was self contained in its own food sack. This process eliminated the tedious and time consuming labor of measuring and allocating stores of bulk food on the mountain. The bags were numbered for each day of the trip guaranteeing the men an ample food supply "because the same amount was waiting untouched" in the next day's provisions.[41] This technique was simple and efficient, and Washburn incorporated it into future expeditions. Its ease and efficiency soon caught the attention of other explorers and mountaineers who began to use it worldwide.[42]

Although the expedition's primary focus was to make the first successful climb of the mountain, Washburn brought into his plans a number of relatively ambitious scientific components. The team's intention was to also document and photograph the region's geologic features and glacial systems and subsequently produce a preliminary survey map of the mountain's approaches.[43] Nevertheless, the expedition was primarily a mountaineering, pioneering undertaking and not one of intense scientific field work. The all-Harvard expedition departed the East Coast of the United States and

---

[41] Ibid., 12.
[42] Charles Houston, Speech delivered to the American Alpine Club meeting, Denver, Colorado, 5 December, 1993.
[43] Bradford Washburn, "Back-Packing to Fairweather," *The Sportsman*, April 1931, 61.

headed north to the territory of Alaska on the thirteenth of June, 1930, arriving in Juneau, Alaska four days later - just seven months after the crash of the US stock market.[44] Their equipment was transferred to a rented 34-foot gasoline power-boat, the *Typhoon,* on which the team would travel for a day and a half to their planned coastal base camp at Cape Fairweather.[45] However, the treacherous ocean currents negated any plans of landing at the Cape. Washburn was forced to establish a base camp within Lituya Bay, the only protected waters in the vicinity and the site of numerous, though cursory previous investigations.[46]

The team now faced a long march to the base of the mountain through glacial moraines and virtually unknown country. The added distance and subsequent time delays taxed the food and fuel supplies they had so carefully calculated and packed. Although a rough map of the Lituya Bay area existed, the team was in relatively virgin country.[47] At nearly every turn they found opportunity to climb, survey, explore and study in a region noted Alaskan geologist Alfred H. Brooks

---

[44] Bradford Washburn, *Bradford on Mount Fairweather*, 15.
[45] Ibid., 16.
[46] Ibid., 26.
[47] O.J. Klotz, "Notes on the Glaciers of Southeastern Alaska and Adjoining Territory," *Geographical Journal* 14 (1899): 524-526.

had proclaimed "par excellence... in which to study glaciers."[48]

The men began their arduous ascent to the base of the mountain and eventually placed camps along the moraine-strewed slopes of Fairweather. The unplanned march to the mountain's slopes challenged the team beyond their expectations. In two weeks, they ferried over fifteen hundred pounds of supplies to their first camp, straining under numbing packs which ranged in weight from forty-five to one hundred and thirty pounds. Eventually, they climbed to an altitude just short of seven thousand feet. There the reality of their diminishing food supplies and shortened timeline became painfully apparent.[49]

With obvious regret, Washburn declared that the "time had come for us to turn back." His first foray among the great peaks of Alaska was a "great disappointment" and this baptism was a "bitter introduction to Alaska Mountaineering." He rationalized that the "risks of so

---

[48] Alfred H. Brooks, *Preliminary Report on the Ketchikan Mining District, Alaska, with Introductory Sketch of the Geology of Southeastern Alaska,*(Washington, D.C.: Government Printing Office, 1902), 31.
[49] Bradford Washburn, *Bradford on Mount Fairweather*, 78.

hurried a campaign would be great."[50] Washburn contented himself with gathering scientific data, including detailed weather records and geologic samples.[51] In addition, Washburn took five hundred still photographs and over five thousand feet of motion picture film of the region's glaciers and mountain landscape. The team also carried out a preliminary ground-based survey from which a map of Fairweather's lower slopes and numerous approaches was produced.[52]

By the summer of 1931, Washburn's skill as an outdoor photographer and mountaineer had reached such prominence that he returned to the Alps to make the first commercial film documentary of an ascent of Mont Blanc for outdoor lecturer Burton Holmes. While Washburn was overseas, two of

---

[50] Ibid., 81; Bradford Washburn, "A Preliminary Report on the Studies of the Mountains and Glaciers of Alaska," The Geographical Journal XCVIII (1941): 219. This report was written a number of years after Washburn's initial explorations in this region to encompass all work done through the 1930's. A discussion of such work is discussed later in this chapter.
[51] Washburn's geologic and fossil samples were added to a rather small yet significant collection taken by a number of geographic expeditions to the region, including that of Mertie in 1917. See, J.B. Mertie, "Geography and Geology of Lituya Bay," in Phillip Smith, *Mineral Resources of Alaska* (Washington, D.C.: Government Printing Office, 1930), 117.
[52] Bradford Washburn, *Bradford on Mount Fairweather*, 82, 35; Bradford Washburn, "Back-Packing to Fairweather," 61.

America's best known alpine mountaineers, Terris Moore and Allen Carpe' made the first ascent of Fairweather, the mountain which had defeated him the prior year. Undaunted by such news and secure in making the issue of claiming a first ascent of secondary importance, Washburn planned another expedition to the mountain in 1932. However, the expedition's focus, unlike the first to Fairweather, was organized to expand the cartographic and geologic work of 1930.[53]

In order to bypass the landing at Cape Fairweather which plagued the 1930 expedition, Washburn employed an airplane to ferry both men and equipment to a nearby lake at the mountain's base. In that purposeful and prescient decision, Washburn permanently incorporated the airplane into the many tools of Alaskan mountaineering and geographic exploration and, by doing so, changed the face of both endeavors from that time forward. It is important to note that improvements made during the first World War as well as the inter-war years in airplane and engine design made possible the use of the plane in such regions and under such adverse weather conditions.[54] Washburn's career became defined and

---

[53] "Will Try to Climb Mt. Fairweather," *New York Times*, 13 June, 1932, p. 8

[54] The important role of various types of vehicles in support of field science is discussed at great length in

identified by his continued utilization of emerging technologies and innovative approaches to geographic exploration. In later discussions we will explore the various ways in which Washburn incorporates new technologies and vehicles, as well as experts in their operation to study and document numerous geographic features such as the Grand Canyon and the Mt. Everest region.

Despite his planning, Washburn's second expedition to Fairweather fared no better that his first. His aircraft was forced to land at Lituya Bay - a great distance from the mountain - due to ice cover on the area's lakes. He revamped his plans, making Mount Crillon, with a height of 12,728 feet, the team's new objective. Although such a diversion was a bitter pill to swallow, Washburn was able to take numerous aerial photographs, capturing for the first time from the air the great expanse of glaciers and geologic formations. The expedition was in effect building upon the region's knowledge base which had begun with those early pioneer explorers throughout the eighteenth and nineteenth century.

David Devorkin, *Science With a Vengeance: How the Military Created the US Space Sciences After World War II* (New York: Springer-Verlag, 1993).

Crillon, the second tallest mountain within the Fairweather Range, had yet to be scaled and a feasible path to the mountain and subsequent route to the summit was still unknown. The team spent the remaining weeks reconnoitering the slopes and glaciers adjacent to Lituya Bay for a possible route to the summit. They spent considerable effort collecting geologic samples, photographing the region's landscape and extending their previous survey work. Washburn reoccupied several existing survey stations established in 1926 by the United States Coast and Geodetic Survey. Additional stations were established within Lituya Bay from which a fairly detailed map was produced. Dr. Hamilton Rice, director of Harvard's Institute of Geographic Exploration, was a significant supporter of the expedition, making the field work possible through the use of the Institute's survey equipment.[55]

Although the Crillon region had not been the expedition's goal to explore, Washburn again combined an energetic plan of mountaineering and scientific exploration, with the latter paramount in these efforts. By late summer of 1932

[55] Bradford Washburn, "A Preliminary Report on the Studies of the Mountains and Glaciers of Alaska," *The Geographical Journal*, XCVIII (1941):222. Much more will be said in this chapter regarding the relationship between Bradford Washburn, Hamilton Rice and Harvard's Institute of Exploration.

the team had spent nearly seventy days in and around Crillon, completing an extensive reconnaissance survey of Lituya Bay, Crillon Lake and Crillon Glacier. Eventually, the mountain's slopes proved more challenging than Washburn and his team were equipped to deal with. Crillon's summit would have to wait until the following year. In fact, Washburn returned to Crillon the following two years to survey and systematically photograph a significant portion of the Fairweather Range from the air, extending the previous ground-based survey data he had obtained.

READING THE ICE

In the spring of 1933 Washburn earned his A.B. and subsequently enrolled for the following fall in Harvard's graduate geology program. His field experience had influenced his academic interests to such a degree that the two now came together. He remained persistent in the region, returning in 1933 and 1934 with expedition teams composed of students from both Harvard and Dartmouth College. Crillon Lake was selected as the team's base of operations, from which Washburn expanded his previous survey stations to more than a dozen and calculated the position and altitude of each peak in the area.[56] Purposefully and meticulously, Washburn's topographical work began to yield significant information about the region's "unknown areas" through precise and extensive geographic surveys.

Like Washburn's previous Alaskan expeditions, the 1933 Crillon expedition did not succeed in reaching the mountain's summit. The team was forced to abort their climb just below the summit by a tremendous blizzard. Nevertheless, the topographic work carried out was indispensable when coupled with the data previously obtained. These efforts, as well as the reconnaissance undertaken in 1932, resulted in the most comprehensive topographical, geological and photographic record of this region at the time.[57] Moreover, the data was subsequently added to the following year's work to create the first detailed map of the region.

---

[56] William Field surveyed and photographed this region in 1926, yet Washburn did not reoccupy Field's stations. See William Field and C. Suzanne Brown, *With a Camera in My Hands*, forthcoming, 60-62. I would like to thank Suzanne Brown, Professor William Schneider and the University of Alaska Fairbanks Oral History Project for making available to me a preliminary copy of this very important oral history of William Field. Washburn's new calculated height of Mount Crillon exceeded that of early estimates made at the turn of the century by the Boundary Commission by a mere one foot, placing it at 12,728 feet.

[57] "Snowstorm Balks Mt. Crillon Climb," *New York Times*, 27 August 1933, sec. 2, p. 1

Washburn returned to Crillon in 1934, determined to expand the scope of his previous topographical and scientific field work.[58] As suggested by glaciologist Dr. James Goldthwait, Washburn selected Goldthwait's son Richard, a recent graduate in geology from Dartmouth, to direct an ambitious study of the flow rate and behavior of the Crillon Glacier.

As a member of Washburn's expedition in 1933, Goldthwait undertook a detailed series of bi-hourly movement observations of the Crillon glacier using a "Tavistock" theodolite and a glacier motion marker. These observations, the most extensive carried out at that time, indicated significant fluctuations in glacial velocity with possible

[58] A detailed map was produced under the auspices of the Institute of Geographic Exploration at Harvard University from data attained by Washburn's Crillon expeditions of 1933 and 1934. This survey data was added to that of previous surveys; U.S. Coast and Geodetic Survey of 1926, coastal aerial photographs of the U.S. Forest Service of 1929. See, Bradford Washburn and Richard Goldthwait, "Lituya Bay and Mount Crillon District," *The Geographical Journal* 87, supplement (June 1936). Topographic data of Crillon's upper slopes were compiled in 1933 and 1934 along the upper slopes of the mountain. Measurements were made by aneroid "spot-heights", the data from which supplemented previous fixed ground-based triangulation. A subsequent series of oblique aerial photographs taken by Washburn in 1934 completed the data collection of the mountain.

diurnal periodicity in flow.[59] However, as this technology and its application were relatively new to glaciology, Goldthwait contended that the data raised more questions than they answered. Therefore, subsequent readings were undertaken the following year from which a check of the data could be made.[60]

In the summer of 1934, more elaborate scientific equipment and survey equipment was transported by plane to the base of Crillon Lake. A permanent survey station was erected adjacent to the Glacier where a cement pillar was built to assure an accurate survey base for the Wild T-3 first-order theodolite. This marked its first use in Alaska. The Institute of Geographic Exploration at Harvard loaned the survey equipment to Washburn, attesting to the school's continued interest in such studies and the extent to which Washburn's skills had been recognized.[61]

---

[59] Bradford Washburn and Richard Goldthwait, "Movement of South Crillon Glacier, Crillon Lake, Alaska," *Bulletin of the Geological Society of America* 48 (1 November, 1937): 1654.

[60] Richard Goldthwait, "Seismic Sounding on South Crillon and Klooch Glaciers," *The Geographical Journal*, 87 (June 1936):496.

[61] Harvard University's Committee on Geophysics supported a number of field initiatives throughout the 1930s, the majority of which were under the auspices of Harvard faculty. This highlights the degree to which Washburn's work was considered important. There exist few published studies which discuss Harvard's role in support of such work. The

The theodolite was used to track relatively minor movements in the glacier by observing, in both day and night hours, a battery-powered light bulb marker, a one-half inch brass tube dubbed the "glacier glider," set upon an eighteen inch box and placed upon the ice.[62] A series of hourly and bi-hourly glacial observations were taken from which the rate of movement was found to be irregular, "varying from zero up to a maximum of nearly 6 centimeters an hour." Weather records kept throughout the same period revealed a significant correlation between ambient temperature and the rate of movement. The glacier "flows faster during warm, sunny weather than when the sun is overcast," with the slowest movement occurring "during a cold rainstorm." Goldthwait and Washburn found four general periods throughout the day when glacial motion intensified.[63]

Although analysis of the data revealed the movement of the glacier to be irregular, the evidence was inconclusive as to the cause for such behavior. However, the data indicated a

---

relationship of the Committee to that of Washburn's work will be discussed in more detail in this chapter.

[62] Bradford Washburn, "The Harvard - Dartmouth Mount Crillon Expedition,", D, May 30 - August 17, 1934, 20, 24, 27. Box 2. file 3.

[63] Bradford Washburn and Richard Goldthwait, "Movement of South Crillon Glacier, Crillon Lake, Alaska," 1655

contradiction to popular theories which held that glacier flow occurred in a slow and steady fashion. Moreover, a number of factors were identified by Washburn and Goldthwait which could affect the rate and time of flow, resulting in a pattern of irregular and even spasmodic movement.[64] Although this evidence seemed to correlate neatly with ambient temperature, humidity and day/night patterns, Washburn recommended additional research to support these findings. In 1936, with a grant from the Geological Society of America's Penrose Fund as well as technical and equipment support from Harvard's Institute of Geographical Exploration, a team of three men (Russell Dow, David Brink and Benjamin Twiss) reoccupied Washburn's survey stations and carried out additional observations.

Their data supported that of Goldthwait and Washburn, indicating very irregular and even "jerky accelerations" of Crillon glacier.[65] As in 1934, the data revealed an acceleration in ice flow during four specific times throughout the day - with a peak movement of twenty millimeters during a single fifteen minute period. These

---

[64] Bradford Washburn, "The Conquest of Mount Crillon," *National Geographic Magazine*, March 1935, 365.
[65] Ibid., 1658; Bradford Washburn and Richard Goldthwait, "Movement of South Crillon Glacier, Crillon Lake, Alaska," 1660-1663.

findings supported numerous observations made on other Alaskan glaciers as well as those found throughout Europe.[66]

In addition to geologic sampling, topographical field work, weather readings, glacial observations and use of innovative technologies in support of such efforts, Washburn introduced geophysical measurements in Alaskan glacier studies by establishing seismic profiles of both Crillon Lake and Crillon Glacier (found to be about eleven-hundred feet). Washburn and Goldthwait were most interested in the precise depth and deposits, as well as the previous location of the glacier as they related to that found during the Pleistocene era. Using detailed seismic soundings of Crillon Lake, they found the U-shaped contour of the lake bed to be consistent with similar discoveries in other glaciated valleys.[67] Goldthwait's geophysical work was made possible by a rather generous stockpile of "40 percent DuPont nitroglycerine dynamite," enough explosive to generate a sufficient seismic waves needed for such a study. [68]

---

[66] R.T. Chamberland, "Instrumental Work on the Nature of Glacier Motion," 36 (1928): 1-30.
[67] Bradford Washburn, The Harvard-Dartmouth Alaskan Expeditions," *The Geographical Journal* 87 (June 1936): 484.
[68] Ibid., 498.

The work was made possible by grants from Harvard's Milton Fund and the influential Harvard Committee on Geophysics. The Committee played a significant role in furthering geophysical research in the United States as an interdisciplinary conduit through which private patrons multidisciplinary work could be marshaled within an academic framework.[69] As a graduate student in Harvard's geology program, Washburn was quite familiar with the institution's prominent geophysics and geology faculty and aware that his interdisciplinary field work was consistent with that of the Committee's interests.[70] Therefore, he obtained not only financial resources for his work but technical assistance as well. Harvard faculty advisors to the Crillon expedition included several eminent geologists including geologist Dr.

---

[69] Funding for the Committee's research came from a number of external patrons. In particular, the Rockefeller Foundation contributed funds in excess of one hundred thousand dollars throughout the 1930's. See, Committee on Experimental Geology, "Thirty-seventh meeting of the Committee on Geophysical Research," January 18, 1940, box UA V 420.125, Division of Geological Sciences files, Harvard University Archives.

[70] Such an interdisciplinary framework was quite common at this time. Ronald Doel has argued that the Committee be equated to that of a "transient institution," addressing academic questions outside the more traditional academic disciplines. See Ronald Doel, "Defining Cooperative Research: The Harvard Experimental Geophysics Committee, 1931-1940, as Basis for Interdisciplinary Work," paper presented at the History of Science Society, 16 October 1994, New Orleans, Louisiana.

kirtley Mather, Professor Reginal Daly, Chair of Harvard's Committee on Geophysics, and Dr. L. Don Leet, newly appointed Harvard seismologist.[71] Washburn to The participation and, indeed, considerable support of such "young" explorer-scientists underscores the importance the committee placed on interdisciplinary expeditionary science. Washburn's seismic work was of particular interest to the committee which supported such work to a considerable degree throughout the 1930's.[72] Indeed, they financed similar

---

[71] While a graduate student at Harvard, Mather was one of Washburn's advisors. In 1938 they co-published "The Telescopic Alidade and Plane Table, as used in Topographic and Geologic Survey," *Dennison University Bulletin* (April 1938). A recent biography of Mather has been written by Kennard Baker Bork, *Cracking Rocks and Defending Democracy: Kirtley Fletcher Mather, Scientisit, Preacher, Social Activist. 1888-1978* (San Francisco: AAS, 1994).

[72] See Committee on Experimental Geology, "Memo to Committee on Geophysical Research," nd, Division of Geological Science files, box UA V 420.125. Seismic exploration became a fundamental component of many major geophysical departments/institutes within major universities in the 1930's. See, for instance, Ronald E. Doel, "The Earth Sciences and Geophysics," in *Science in the Twentieth Century*, John Krige and Dominique Pestre, eds., (London: Harwood Academic Press, 1997), 10. Seismic exploration was quite common in oil prospecting. Harvard faculty utilized seismic exploration to better understand Earth's structure, publishing extensively throughout the 1930's and 1940's on this very subject. See for instance, John Munro, *Geophysics at Harvard*, (Cambridge: Harvard University Press, 1940), 30-32. For an excellent synthesis of major patronage for exploration geophysics, in particular that of The Rockefeller Foundation, the significant source of funding for Harvard's foray into geophysics, see Robert E. Kohler,

research during Admiral Byrd's first Antarctic expedition (1928-1930) and provided additional funding for continued seismographic investigations of the Antarctic ice sheet during Byrd's subsequent Antarctic work.[73]

The use of geophysical techniques to study glaciers was a relatively new, yet powerful tool for the emerging field of glaciology. Prior to 1934, only a few published accounts of similar studies were available, although such techniques were frequently employed by private industry in the exploration for oil and mineral deposits.[74] Perhaps this is why Goldthwait suggested careful analysis of this new application, stating that initially it may raise "more questions than it answers." However, he believed that the

---

Partners in Science: Foundations and Natural Scientists 1900-1940, 256. After 1945 geophysics at Harvard had expanded greatly, forcing the school to solicit additional patrons. A very pointed text entitled "Geophysics at Harvard," complete with an opening aerial photograph of Alaska's Bernard Glacier by Bradford Washburn, was distributed in an effort to lure additional funding. See, John Monro, *Geophysics at Harvard.*

[73] Ibid., R.A. Daly to C.G. Morgan, 30 September, 1933.

[74] Richard Goldthwait, "Seismic Sounding on the South Crillon and Klooch Glaciers," 496. German geologist Hans Mothes first developed and employed this technique from 1926-1929 on the Aletchgletscher and Hintereisferner in the Alps. See for instance, Hans Mothes, "Dickenmessungen von Gletschereis mit Seismischen Methoden," *Zeitschrift fur Geophysik* 3 (1927): 121-144; B. Brockamp and Hans Mothes, "Seismische Untersuchungen auf dem Pasterzengletscher, I, *Zeitschrift fur Geophysik* 6, (1930): 482-500.

"unearthing" of such problems "is an encouraging indication" that such a method "may some day yield definite answers."[75] During the Crillon expeditions, in particular the 1934 field season, Washburn introduced aircraft in support of scientific and geographic exploration and equipment and personal transport in remote regions. However, of particular interest and significance was its use in the relatively young yet burgeoning fields of aerial photography and photogrammetry.[76]

---

[75] Richard Goldthwait, "Seismic Sounding on the South Crillon and Klooch Glaciers," 496. Goldthwait returned to Crillon Glacier in the 1960's, documenting its cycle of recession and advances as well as the prehistoric and historic changes which occurred in the surrounding area. See, Richard Goldthwait, Ian McKeller and Casper Cronk, "The Fluctuations of Crillon Glacier System, Southeast Alaska," *Bulletin of the International Association of Sci. Hydrology* 8 (1963): 62-74; William Field, *Mountain Glaciers of the Northern Hemisphere*, 188-189. For related work in Glacier Bay, Alaska, see for instance, Richard Goldthwait, "Dating the Little Ice Age in Glacier Bay, Alaska," *Report on the International Geological Congress, XXI Session, Norden* (1963): 37-46. Eventually, Goldthwait would follow in his fathers footsteps, rising to become one of the most distinguished American glaciologists of the twentieth century. For a synopsis of Goldthwait's career and abbreviated bibliography of his publications, see Albert Lincoln Washburn, "Memorial to Richard Parker Goldthwait: 1911-1992," *The Geological Society of America* 23, (1993): 167-170.

[76] For an early history of aerial photography and photogrammetry, see, for instance, Ashley C. McKinley, *Applied Aerial Photography* (New York: John Wiley & Sons, Inc., 1929). McKinely was an instructor in aerial photography during the First World War for the U.S. Army Air

In the summer of 1934, Washburn chartered a Lockhead Vega seaplane equipped with pontoons, to fly from Juneau to Crillon Lake in order to transport the expedition's entire cache of equipment. The plane also was used to airdrop supplies and scientific equipment for eventual use by the team along Crillon's upper slopes. Large trunks, painted orange for easy identification in the vast sea of white ice, were strategically dropped in pre-designated areas without parachutes. Washburn tossed each trunk out the plane's main door allowing for a "terrific drift due to our speed and altitude of at least 1,000 feet above the snow field." A detailed list of each box's contents was kept and a map indicating the "last known position" of the boxes was kept for future reference.[77]

On the morning of July 12, 1934, Washburn and Goldthwait embarked upon the first-ever extensive and detailed aerial photographic reconnaissance of the region. The photographic survey was underwritten by the Penrose Research Fund of the Geological Society of America, whose leaders were particularly interested in obtaining aerial photographs of

---

Corps and served as aerial surveyor for Admiral Byrd's Antarctic expedition.

[77] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 13-14.

the unique banding characteristics of the Malaspina Glacier. Grantland Rice donated additional financial support to the project, making possible an expansion of the reconnaissance to include the peaks and glaciers of the St. Elias Range.[78] As the plane ascended to a height of ten thousand feet, Washburn removed the plane's door windows, placed his large k-3 aerial camera in his lap and leaned out into the frigid air high above the ice fields. Carefully perched with a hemp rope wrapped about his waist and tied off to the plane's internal frame, he photographed Lituya Bay, Yakatat Glacier and the receding Nunatak Glacier, where Washburn found its ice front to be "where the *1000 foot contour-line* is on the old map."[79] Exposure to the raw elements at nearly three vertical miles above the glacier took its toll on the photographer and crew, "I had lost all sensation in my knees" Washburn recalls, but took pictures "until my fingers were sore."[80] The Nunatak had, to this time, experienced numerous recessions from its maximum advance during the

---

[78] Ibid., 1. The aerial exploration was supported by a five hundred dollar grant from the Penrose Fund. Penrose would underwrite the follow-up glacial investigations of the 1934 Crillon work which took place in 1936 - previously discussed in this chapter. In addition, three thousand feet of photographic film as well as an additional five hundred dollars from Grantland Rice.

[79] Ibid., 30.

[80] Bradford Washburn," The Harvard-Dartmouth Mount Crillon Expedition," 30-31.

eighteenth century which were documented at the turn of twentieth century by Gilbert as well as Tarr and Martin.[81] Indeed, the latter had found significant recessions of the Nunatak from 1895-1909 followed by a two year advance. However, the advance was short-lived as the glacier once again receded between 1911 and 1913.[82]

The broad significance of this work lies in the addition of such information to the scientific record already assembled prior to Washburn's arrival in the region. Moreover, such photographs serve as a highly effective tool in the description of glacial location when viewed from the air. Washburn did not advance specific theories as to the mechanisms responsible for glacial movement, although, as we soon will see, he does indicate that climate change may be responsible for such dynamics. Nevertheless, such photographs provide a record from which modern-day glaciologists and meteorologists may compare today's glacial termini with those of Washburn's findings.

---

[81] Grove K. Gilbert, *Harriman Alaska Expedition*, Vol. 3 (New York: Doubleday, Page & Co., 1903) 58-63; Ralph Tarr, "The Yakatat Bay Region, Alaska: Part I, "Physiography and Glacial Geology," *United States Geological Survey Professional Paper* 64 (1912):54-59; Ralph Tarr and Lawrence Martin, *Alaska Glacier Studies*, 131-145.
[82] Ibid., 139-141

The Nunatak glacier had not been explored in the intervening years and Washburn had documented its surface for the first time from the air, affording researchers an exciting and scientifically significant perspective of the entire area. Washburn discovered that the glacier had receded an additional six miles since Tarr and Martin's observations two decades previous.[83] These calculations and observations were later supported by those made by Maynard Miller in 1946-1947, contributing to the history of glacial surges and recessions previously documented by numerous expeditions.[84] From the Nunatak Glacier the plane headed towards Hubbard Glacier, the largest tidewater glacier in North America.[85] From this vantage point, Washburn noted that the "Turner, Haenke, Varigated and Hubbard seem to be essentially where they were 30 years ago."[86] Until this time, no known extensive observations had been documented about glaciers

---

[83] Bradford Washburn, "Morainic Banding of Malaspina Glacier and Other Alaskan Glaciers," *Bulletin of the Geological Society of America* 46 (1935): 1885.

[84] Maynard Miller found Nunatak Glacier to have receded about six and one half miles during the same period. Maynard Miller, "Observations on the Regimen of Glaciers of Icy Bay and Yakatat Bay, Alaska, 1946-47," (Master's Thesis, The Faculty of Pure Sciences, Columbia University, 1948): 40.

[85] William Field, *Mountain Glaciers of the Northern Hemisphere*, 225.

[86] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 30.

subsequent to those of Russell(1890-1891), Gilbert (1899) and Tarr and Martin (1905-1913).

Washburn's photographs visually captured Alaska's glacial landscape and mountain ranges for the first time as an integrated and interdependent network of geologic processes. Until this time, photographic and scientific observations were limited to ground based survey stations, most often located at glacial termini. As the eminent scientist William Field has observed, this was largely due to the "difficulty in making observations at higher levels," a domain left to those hearty "mountaineering or surveying parties" who "could extend their activities above the neve' line."[87] However, such observations were limited in their scope when compared to those taken from the air. This is not to say that ground-based surveys were not of significant worth. Indeed, they are a fundamental ground control and without such data, accurate topographical maps would not be possible. Rather, the aerial dimension Washburn developed enhanced and amplified the work previously undertaken.

Moreover, scientists were able to more easily study and map these networks as part of the larger, total ice system of

---

[87] William Field, "Glaciological Research in Alaska," ed. Henry Collins, *Science in Alaska*, 127.

which they were a part. Glacial characteristics and behavior such as crevasses, annual bands and moraines could be seen in a new dimension - visually, dynamically and inherently part of the larger mountain-glacier system. Field noted that the airplane, in the employment of a skilled photographer, "made possible an expansion in the scope of glacier studies in Alaska."[88] Quite simply, Washburn was on the cutting edge of these techniques and the first to implement them in Alaska on such a grand scale.

A primary objective of 1934 aerial reconnaissance (as well as a shorter and less extensive 1933 survey) was to photograph the extensive ice system, in particular, the medial and annual bands of the Malaspina Glacier. Similar work planned for the prior year had been unsuccessful. However, Washburn proclaimed the 1934 Malaspina work to be "perfect... getting pictures of the bands" from a maximum altitude of sixteen thousand feet. He also documented from the air the unique forest growth which tenuously spouts from the terminal ice and moraines of the glacier: the "end of the glacier is covered by trees... but not so widely spread and only a fringe at the coast."[89] Washburn carried out a series of detailed photographic studies of the "surficial

---

[88] Ibid.
[89] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 30.

phenomena of the glacier in an attempt to solve from the air the problem of their origin."[90] The severe temperatures and flying conditions failed to daunt Washburn's enthusiasm as he realized the significance of his work. As he later wrote, "What a marvelous view to get an idea of the vast extent of the glaciers there in the Pleistocene."[91]

The Malaspina Glacier had long been the subject of a number of scientific investigations prior to Washburn's photographic survey. Located in the Yakatat Bay region, the Malaspina is categorized as a piedmont glacier, an impressive expanse of ice created by the convergence of several tributary glaciers, of which the Seward Glacier is most extensive.[92] While exploring the Yakatat Bay region in 1874, Dall and Baker made note of the glacier but were not able to study further its unique surface characteristics. They returned in 1880 and documented its impressive low-

---

[90] Bradford Washburn, "Morainic Banding of Malaspina and Other Alaskan Glaciers," 1981.
[91] Ibid., 31.
[92] Israel Russell, "An Expedition to Mount St. Elias, Alaska," 57, 122. William Field, *Geographic Study of Mountain Glaciation in the Northern Hemisphere: Alaska and Adjoining Parts of Canada, Part 2a* (New York: American Geographical Society, 1958): 21; William Field, *Mountain Glaciers of the Northern Hemisphere*, 233-234; Bradford Washburn, "Morainic Banding of the Malaspina and Other Alaskan Glaciers," 1881; Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 44.

lying ice plateau, to which they gave the name Malaspina Glacier, in honor of the Italian explorer.[93] Ten years later, Israel Russell placed the glaciers of the St. Elias Range within two distinct groups. He categorized the first group as *Alpine Glaciers,* or "ice-streams" similar to the "type found in Switzerland."[94] Russell found that the formation of massive ice plateaus, such as the Malaspina, occur "where alpine glaciers leave rugged defiles through which they flow and expand and unite on an adjacent plain."[95] He compared this type of glacier to "a vast lake of ice" and named this heretofore unrecognized ice system a *Piedmont* Glacier.[96]

As a result of this particular convergence and interaction of ice streams and the subsequent geologic debris deposited from such a union of ice, in this case referred to as the Seward-Malaspina Complex, the Malaspina's surface is scarred with extensive medial moraines. The glacier also exhibits

---

[93] William H. Dall, *Coast Pilot, Alaska*, Pt. 1 (Washington, D.C.: 1883), 212.
[94] Ibid., 176.
[95] Israel Russell, *Glaciers of North America*, 3.
[96] Israel Russell, "Mt. St. Elias and its Glaciers," 170; Israel C. Russell, "An Expedition to Mount St. Elias," 185-186. The Malaspina is the largest Piedmont glacier in North America spanning 850 square miles, see Henning, *Alaska's Glaciers* (Anchorage: The Alaska Geographic Society, 1982), 87.

darkened bands of debris known as "annual bands," described by Tarr and Martin as "long, sinuous lines of scroll-like moraine, forming a black tracing in the expanse of clear white ice." However, they failed to fully identify their origin or behavior, admitting that the phenomenon was "difficult to understand."[97] Russell suggested the bands were the result of variation in ice flow, whereas Tarr and Martin hypothesized their origin to be the product of rock and avalanche ice which had fallen onto to the upper reaches of the glacier, subsequently spreading out across its surface over time.[98]

Washburn's photographs and subsequent study of such led him to propose a number of theories as to the origin and behavior of both morainic and annual banding. He theorized that the Malaspina's contorted moraines were a result of the "spasmodic variations in volume of the many tributary glaciers" feeding into it.[99] In this sense, Washburn and Russell were in agreement. However, the cause of these variations was not known. Ralph Tarr suggested that the observable variation in ice flow and glacial advances

---

[97] Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 44.
[98] Ibid.
[99] Bradford Washburn, "Morainic Banding of Malaspina and Other Alaskan Glaciers," 1882.

throughout the Yakatat Bay region to be a result of "avalanching during earthquake shaking," the result of which is a magnificent force capable of moving great volumes of ice. This proposal formed the basis of his Earthquake Advance Theory.[100] Tarr dismissed other theories such as climactic variations and snowfall accumulations (or mass-balance), noting that only a "very notable addition to the reservoirs could bring about so spasmodic and so great a forward movement."[101]

Washburn supported Tarr's assertion, arguing that his survey of the Malaspina reinforced the notion that contorted moraines were a result of the pressure exerted onto the debris by great volumes of ice triggered by large regional earthquakes. Through his graduate studies and devoted readings in this area, Washburn found "completely acceptable... this 'earthquake advance theory'" responsible for "the patterning of Alaskan moraines."[102] However, this theory was deemed suspect by subsequent researchers, including Austin Post and Maynard Miller. Miller argued that

---

[100] Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 168. See also Ralph Tarr, "Recent Advance of Glaciers in the Yakatat Bay Region, Alaska," *Bulletin of the Geological Society of America* 18 (1907): 277-286

[101] Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 175.

[102] Bradford Washburn, "Morainic Banding of Malaspina and Other Alaskan Glaciers," 1882.

earthquakes are "but a supplemental and generally minor factor" in glacial advances, and the primary catalyst was a result of "meteorological causes."[103]

Although Washburn supported the theory, he did leave sufficient room for additional interpretations: "Either this or some complex climatic change may be the cause" for the variations in the ice flow.[104] This issue would long remain uncertain with current research affording additional insight.[105] Regardless of the underlying fundamental causes for the spasmodic glacial flow of the Malaspina's tributaries, Washburn's aerial photographs, for the first time, clearly portrayed the entire Malaspina network, complete with its complex sequence of tributaries,

---

[103] Austin Post, "Effects of the March 1964 Alaskan Earthquake on glaciers," *United States Geological Survey Professional Paper*, 544-D (1967): 38-41; Maynard Miller, "The Role of Diastrophism in the Regimen of Glaciers in the St. Elias District, Alaska," *Journal of Glaciology* 3 (1958): 296.

[104] Bradford Washburn, "Morainic Banding of Malaspina and Other Alaskan Glaciers," 1882.

[105] Current research is still being conducted on many of Alaska's glaciers in an effort to identify the mechanism or mechanisms responsible for glacial flow and surges. Recent data indicate mechanisms responsible for glacial surge are more a function of faulty "plumbing" within the glacier, rather than a result of climactic change. See Barclay Kamb et al, "Glacier Surge Mechanism: 1982-1983 Surge of Variegated Glacier, Alaska," *Science* 227, no. 4686 (February 1985):478-479; Professor Will Harrison credits Austin Post with first advancing such a theory.

converging into one massive ice lobe at its terminus. Although Dall, Russell, Tarr and Martin had studied and photographed from the ground the Malaspina's glacial surface and unique valley terminus, Washburn's ability to capture from the air such images afforded a visual understanding of the interaction and interdependence of the entire Malaspina-Seward glacial complex. It should be underscored that Washburn's photographic work captured the aesthetic beauty and scientific value of the region in such a way as to provide a crucial insight into entire region's dynamic characteristics.

Washburn was also interested in photographing and studying the annual bands found along the surface of the region's glaciers. From such work he advanced not only descriptions of the phenomenon but also provided some thoughts on their development. However, a discussion of the processes responsible for such banding and the degree to which this issue is currently understood will be of assistance in placing Washburn's work in context.

The annual banding of many of the world's steepest mountain glaciers was indeed a topic of debate during the late nineteenth and early twentieth century. Russell, as well as Tarr and Martin, noted that annual banding was clearly evident on Alaskan glaciers, yet, as previously stated, their origin was not fully understood. Subsequent research would show that the bands, now referred to as "ogives," only develop within glacial icefalls, yet not all icefalls generate ogives.[106]

There are two distinct forms of ogives. "Forbes bands," named for the Scottish geologist who first described them, are characterized by alternating light and dark bands or "waves".[107] Topographic waves evident on the surface of a glacier just below an icefall are known as "wave ogives" and, as Sharp points out, "consist of a series of transverse swells and swales."[108] Like Forbes Bands, wave ogives are created by glacial ice flowing over and through an icefall, and represent one year's advance of the glacier.[109] Although both types of ogives are created within the icefall, their

---

[106] Robert Sharp, *Glaciers* (Eugene: University of Oregon, 1990), 68; Michael Hambrey and Jurg Alean, *Glaciers* (Cambridge: University of Cambridge Press, 1992), 64.
[107] For the evolution of Forbes' theory see, J.D. Forbes, *Travels Through the Alps of Savoy* (Edinburgh: Simpkin, 1843). See also, J.E. Fisher, "The Formation of Forbes Bands," *Journal of Glaciology* 1, (1951): 580-581, J.E. Fisher, "Forbes and Alaskan 'Dirt' Bands on Glaciers and Their Origins," *American Journal of Science* 245 (1947): 137-145.
[108] Robert Sharp, *Glaciers*, 63.
[109] Michael Hambrey and Jurg Alean, *Glaciers*, 64; E.D. Waddington, "Wave Ogives," *Journal of Glaciology* 32 (1986): 325.

formation is dependent upon two very different and distinct mechanisms.

King and Lewis showed that Forbes bands are created by the accumulation above and subsequent passage through the icefall of debris-laden ice in summer months and snow in winter months. As the dark summer bands and lighter winter snow bands pass through and are compressed by the icefall, they emerge as alternating narrow set of bands.[110] Indeed, Forbes envisioned the bands to be the "true annual rings of the glacier, like those of a tree."[111] Washburn's aerial photographs of the Malaspina and adjacent glaciers, as well as surveys carried out in Europe of the Mer de Glace, vividly portray the Forbes Band phenomenon on a grand scale. A significant portion of glacial flow above and below the icefall, in particular, can be seen in these photographs, allowing for detailed and enhanced study of glacial banding. In addition, these photographs allowed Washburn the opportunity to speculate as to the creation and dynamics of both Forbes bands and wave ogives, although the later term had not yet been developed. Washburn understood that the

[110] C. King and W. Lewis, "A Tentative Theory of Ogive Formation," *Journal of Glaciology* 3 (1961): 913-39; see also Robert Sharp, *Living Ice* (Cambridge: Cambridge University Press, 1988), 36.
[111] J.D. Forbes, *The Theory of Glaciers* (Edinburgh: 1859), 25.

formation of both types of bands was contingent upon ice flow through an icefall. However, he was aware of the fact that Forbes Bands and wave ogives were the result of two distinct yet significantly different processes.[112]

Washburn's photographs visually captured and depicted the dynamics of ice behavior, allowing for detailed study of the ice movement immediatly before, passing through and after its flow through an icefall. He found the relatively smooth ice above the icefall to abruptly end and fragment into shattered blocks which then flow through and over the brink of the icefall. At the foot of the fall, ice blocks lay jumbled on the glacier's surface where they are annually melted down by the process of ablation. The result is a sea of valleys and troughs evident as the glacier advances. "In place of every ridge," Washburn noted, "a band of white remains, and in the spot once occupied by every hollow lies a dirt-band."[113] Thus, in addition to alternating light and dark bands, topographic waves or wave ogives are also evident.

Washburn surmised that annual seasonal variation from year to year was responsible for significant ablation of ice

---

[112] Bradford Washburn, "Morainic Banding of Malaspina and Other Alaskan Glaciers," 1887.
[113] Ibid., 1888-1889.

blocks at the foot of the icefall during the summer months, thus creating "hollows" in which debris accumulates (Forbes Bands). Moreover, a combination of colder temperatures and snow accumulation during winter months "leads to the formation of a wave of ice instead of a hollow." Washburn's description is not unlike the "swell and swale" description of wave ogives advanced in later years by Sharp.

A similar process was proposed by Nye in the 1950's and subsequently supported by Vallon's research findings on the Mer de Glace.[114] However, Nye found that wave ogives were indeed a result of seasonal mass-balance above the icefall and the deformation of the ice as it passed through the fall. In the falls, Nye found that large vertical blocks of ice experienced considerable horizontal stretching that increased surface exposure to summer sun, resulting in increased ablation and the creation of troughs in a wave ogive system.[115] Washburn noted and photographed the deformation and plasticity of glacial ice, particularly on the Malaspina Glacier in 1934. However, he did not attribute the mechanics of ice deformation in the icefall as a contributing factor in wave ogive generation.

---

[114] E.D. Waddinton, "Wave Ogives," 326.
[115] Ibid.

Washburn's aerial photographs and ground surveys conducted throughout the Mount Crillon area captured, for the first time, dynamic geologic processes at work on a grand scale. He also proposed mechanisms responsible for the creation of glaciological features, some of which were supported many decades later. The best summary of the significance of Washburn's theories regarding the dynamics of glacial movement might be that of glacioloist E.D. Waddington, who in 1986, declared that Washburn "suggested that the annual mass-balance cycle could cause wave ogives." Waddington stated that Washburn had formulated this hypothesis by interpreting the visual landscape from photographs taken from above the glacial surface but "did not attempt to formulate the principle mathematically."[116]

In analyzing Washburn's work in Southeast Alaska in terms of photographing the landscape and subsequently presenting theories as to the dynamics at play in the regions formation, it is tempting if not compelling to draw comparisons between the work of John Muir and Bradford Washburn. Each contributed uniquely to our understanding of

---

[116] Ibid. In 1948, The Arctic Institute of North America initiated "Project Snow Cornice" which built significantly upon the work of Washburn and others within the Seward-Malaspina system. See, William Field, "Glaciological Research in Alaska," in *Science in Alaska* 127-128.

the natural world, yet neither would be considered a "scientist" by their near contemporaries who were engaged in increasingly stratified and "specialized" scientific disciplines. Each approached the investigation of the natural world in rather a more comprehensive fashion, looking for the interconnectedness of the processes which underlie the study of geology. Each man, whether by pen, sketch book or "modern technologies," afforded a new vision of the land and new avenues for the appreciation and further study of the mountain landscape.

Each of Washburn's Alaskan expeditions (Mount Fairweather in 1930 and Mount Crillon in 1932 and 1933) had failed to accomplish its mountaineering goal. Nevertheless, throughout the summer of 1934, Washburn's Crillon team established depots along the mountain's slopes with the support of aerial supply flights. The earlier photographic flights were used to identify reasonable paths to the summit. This was a technique Washburn would employ on all subsequent Alaskan expeditions.[117] As we will later see, Washburn would employ aerial photography and route identification in the Mount McKinley region, the Grand Canyon and eventually above the slopes of Mount Everest.

---

[117] Bradford Washburn, "Harvard-Dartmouth Mount Crillon Expedition," 31.

In addition to successfully carrying out geophysical work and a comprehensive aerial reconnaissance of the Crillon-Malaspina region, the 1934 Mount Crillon expedition attempted to climb the mountain on which they had labored all summer. On July nineteenth, Washburn, Henry Woods, Ad Carter and Hal Kellog set out for Crillon's summit from their high camp at eight thousand feet. The four men began their assault at two A.M., yet, by six forty-five that morning it became apparent that a smaller team with additional food supplies would have a better chance of making the summit.[118] Washburn and Carter were selected to continue the climb, eventually reaching Crillon's snow-capped summit later that afternoon. "We planted our axes in the peak of Crillon," Washburn noted, "and shook hands till our wrists ached!"[119] A few summit photographs were taken with Carter's "little" camera as Washburn had left his larger and heavier camera behind.

Back at high camp the following day, Washburn found the lens on his camera was loose, jeopardizing what pictures he had taken up to the time the camera was cached. Washburn's decision to reclimb the mountain, so that a proper

---

[118] Ibid., 39.
[119] Ibid., 41

photographic account of the summit could be attained, was welcome news to the team members who had been left behind the previous day. "I determined that we better do something to make up for our loss," Washburn proclaimed and "try Crillon again and do it immediatly," bringing along "the movie camera and all the still cameras" to "assure my reputation" as an accomplished expeditionary photographer.[120] Indeed, Washburn and the rest of the team did secure a considerable number of quality photographs and moving film, reaching the summit late that morning with no less than thirty-five pounds of camera equipment.[121]

As previously noted, Washburn introduced many new techniques and technologies into Alaskan expeditionary science and mountaineering. This included the utilization of radio communication which Admiral Byrd employeed on his first Antarctic expedition in 1929-1930.[122] Byrd enlisted noted radio pioneer Lloyd Berkner to install communication equipment on his four planes similar to that which Berkner had devised for Amelia Earhart's transatlantic flight.[123]

---

[120] Ibid., 43-45.
[121] Ibid., 45.
[122] Richard Evelyn Byrd, "The Conquest of Antarctica by Air," *National Geographic Magazine*, August 1930, 127-238.
[123] Allan Needell, *Horizons of Lloyd Berkner*, draft manuscript, 30. I would like to thank Allan Needell for his permission to quote from this work. See also Allan Needell, "Lloyd Berkner and Science-Statesmanship," in Peter Galison

Additionally, Byrd's entire expedition stayed in close radio contact and was "convinced of the value of radio to the safety and success" of the expedition.[124] Breakthroughs in radio technology had made such communication a viable and, indeed, critical tool in remote scientific exploration.

Washburn's team relied on "portable" twenty-pound five-meter high frequency, 56 megacycle radio telephones for intercamp communications. Subsequently, the radio played a vital role in coordinating the numerous glacial, cartographic and geologic projects Washburn directed: "It is truly marvelous to be able to hear detailed reports by voice from the high camp while things are going on." [125] As the team was situated in areas which did not always afford line-of-sight communication, Washburn found that the team's ability to communicate in such fragmented terrain "proves that the waves will bend around ridges," an engineering problem still being fine-tuned at the time.[126] He relied also on the radio telephone to conduct the tedious aerial re-supply efforts, coordinating ground to air communication in support of the

---

and Bruce Hevly ed., *Big Science: The Growth of Large-Scale Research* (Stanford: Stanford University Press, 1992),294.
[124] Berkner to Dellinger, 11 May 1929, Dellinger files, RG 167, Box 19; quoted in Needell, *Horizons of Lloyd Berkner*, 29.
[125] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 17-18.
[126] Ibid., 18.

expedition's goals. Moreover, the use of a short wave radio and transmitter tower allowed for continued communication with Juneau and as far as the continental United States.[127] Washburn, like Byrd, found the radio to be "the most vitally important factor in the success of this expedition."[128]

A LASTING PARTNERSHIP

Of all of Washburn's early accomplishments in Alaska, perhaps the most significant and innovative was the taking and utilization of oblique and vertical aerial photographs and their subsequent use in map production. Although Washburn's aerial photographs ushered in a new era in Alaskan field exploration, the utilization of limited aerial photography had been employed prior to the 1930's in Alaska and throughout select remote regions.[129] Prior to the turn of the century, the United States Coast and Geodetic Survey employed ground-based photographs to compliment their work

---

[127] Ibid., 17; Bradford Washburn, "The Conquest of Mount Crillon," *National Geographic Magazine*, March 1935, 367.
[128] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 43.
[129] Aerial photography was used to map the frontier of India during this time. See, D.R. Crone, "Mapping From the Air," *Geographical Journal* 84, (July 1934):149-153. See J.S. Salt "Photographs From the Mount Everest Flight," *Geographical Journal* 82, (July 1933): 54.

along the International Boundary.[130] Indeed, the first application of panoramic photograph in topographic surveys in Alaska was initiated in 1904 by C.W. Wright.[131] Moreover, the utilization of the camera in support of plane-table field survey work was introduced to Alaska by Major J.W. Bagley prior to the First World War.[132] R.H. Sargent of the United States Geological Survey, in cooperation with the United States Navy, employed aerial photography to survey the Inside Passage a full decade before Washburn arrived in the region.[133] Furthermore, Admiral Byrd's Antarctic expeditions had obtained significant vertical and oblique aerial photographs from which survey maps of the Antarctic were produced.[134]

Although aerial photography was well advanced by the nineteenth century from balloon and kite platforms, the use

---

[130] J.A. Flemer, "Photographic Methods and Instruments," *United States Coast and Geodetic Survey Report for 1897* Washington, D.C.: Government Printing Office, 1898), 619-735.

[131] J.W. Bagley, "The Use of the Panoramic Camera in Topographic Surveying," *U.S. Geological Survey Bulletin 657* (Washington, D.C., 1917), 7.

[132] Ibid., 14.

[133] R.H. Sargent and F.H. Moffit, "Aerial Photographic Surveys in Southeastern Alaska, "*U.S. Geological Survey Bulletin* 797-E (Washington, D.C.: Government Printing Office, 1929),144.

[134] Richard Evelyn Byrd, *Little America: Aerial Exploration in the Antarctic* (New York: G.P. Putnam's Son's, 1930),

of a camera from a fixed wing plane did not occur until the historic flight in 1909 of Wilbur Wright.[135] The further refinement of the airplane and photographic films and equipment allowed for the increased application of aerial reconnaissance and photography of troop movements and battlefields from airplanes throughout Europe during World War I. Indeed, the necessity of knowing the enemy's whereabouts spurred major advances in and the application of these techniques and, as Arthur Robinson points out, during the first half of the twentieth century nothing "had exerted so great an influence on geographic cartography as has the occurrence of two world wars."[136]

During the inter war years, technical advances in photography and aircraft engineering were transposed to private industry and subsequently to domestic applications.[137] As evidenced by both Byrd and Washburn, such advances became a vital component of geographic and scientific exploration. Historian Ronald Doel points out that photography of "expeditionary science" provided a

---

135 Ron Graham and Roger Read, *Manual of Aerial Photography* (London: Focal Press, 1986), 4.
136 Arthur H. Robinson et al, "Geographic Cartography," in Preston E. James and Clarence F. Jones, ed, *American Geography: Inventory and Prospect* (Syracuse: Syracuse University Press, 1954), 558.
137 Ron Graham and Roger Read, *Manual of Aerial Photography*, 9-10.

powerful tool to detect and explain natural phenomena, and lured potential patrons, through tangible "evidence" of their patronage at work, to subsidize future endeavors .[138] Indeed, if a landscape photograph possessed such power, an aerial photograph would have perhaps even more redeeming aesthetic and scientific value.

Photographs such as those taken by Washburn not only illustrated geographic features and geological processes, they afforded a new "aerial dimension" and dramatically portrayed a dynamic landscape. He captured Alaska's vast ice-laden mountains in a visually compelling fashion, stirring the romantic yearnings of many an armchair explorer. In doing so, Washburn's work afforded a tangible dividend for future patrons, scientists and the general public, and he grasped fully this significance.

Washburn focused his efforts on obtaining the best possible large format mountain photographs as they dramatized the landscape and more accurately portrayed its detail.[139] This was the essence of his skill and the difference between

---

[138] Ronald Doel, "Expeditions and the CIW: Comments and Contentions," 79-87, in Gregory Good, ed., *The Earth, the heavens and the Carnegie Institution of Washington* (Washington, D.C.: American Geophysical Union, 1994).
[139] Bradford Washburn, interview with Mike Sfraga, Boston, Massachusetts, 23 June 1992.

Washburn's photography and that of his colleagues. He was determined to capture the natural landscape on its own terms, without regard to the difficulties in doing so. "When people climb big mountains," he would later recall, "there are always excuses why the photos didn't come out." He was determined not to make similar claims and found it "fascinating... to take large format pictures in difficult circumstances and somehow or other make them come out."[140] The early master of large format mountain photography was the celebrated Italian photographer Vittorio Sella, whose mantra, "Big scenery should be photographed with big negatives" Washburn incorporated and elevated, both in figurative and literal terms.[141]

Washburn's large format techniques brought out the dramatic relief and vivid geologic patterns far better than previous Alaskan photographic surveys carried out by the Navy, Forest Service or other state and federal branches who were concerned mostly with broad geographic data and boundary issues. And although these agencies were motivated by very

---

[140] David Roberts, "Bradford Washburn," *American Photographer*, April 1983, 46.

[141] For the career of Sella, see Ronald Clark, *The Splendid Hills: The Life and Photographs of Vittorio Sella* (London: Phoenic House Limited, 1948); see also Arnold Lund, "Vittorio Sella," in *A Century of Mountaineering: 1857-1957* (London: George Allen & Unwin Ltd., 1957), 126-129.

different goals (i.e. International Boundary issues and coastline surveys), Washburn's ferocious appetite for venturing deep within Alaska's mountainous terrain, and his artistic eye, underscored his unique and significant contributions to Alaskan geographic and geologic discovery. As discussed later in this chapter, Washburn's photographic record became a valuable benchmark and framework for those scientists who ushered in large scale glaciological research in Alaska in the mid 1940's.[142]

In August of 1934, the Crillon expedition came to a close, attaining its mountaineering, cartographic, geologic and photographic goals. This was a most impressive list of accomplishments for such an ambitious endeavor. The *National Geographic Magazine* purchased the rights to Washburn's official expedition account as its publisher Gilbert Grosvenor, was particularly interested in securing first publication rights of Washburn's photographs. Grosvenor recognized early that the superior quality of Washburn's work clearly satisfied the Society's rigid standards of professionalism. Indeed, Washburn's photographs were intriguing, both aesthetically and scientifically, and

---

[142] Maynard Miller, "Observations on the Regimen of the Glaciers of Icy Bay and Yakatat Bay, Alaska: 1946-1947," *Special Report: Foundation for Glacial Research* (Seattle: Foundation for Glacial Research, 1955), 20.

Grosvenor recognized their powerful appeal. It is easy to understand Grosvenor's frustration when he found that Washburn had sold a few advance expedition photographs to the *New York Times*. As Grosvenor wrote to Washburn, "The value of your material to us is very much lessened if you have arranged for the widespread publication of it elsewhere."[143]

Washburn explained his motives to Grosvenor, stating that "every cent of the costs of the expedition this year has been made from lecturing or selling photographs." He apologized for the necessity of selling the pictures and would not have done so if "I had thought that so few pictures would make a difference to the Geographic article."[144] Although Washburn's Harvard education was paid for in part by his uncle, he required additional financial support and had numerous outstanding expedition bills to pay. He had cashed in a life insurance policy to fund his 1933 Crillon expedition and now found himself in difficult financial status. He confided to Grosvenor that he was "up against the problem of making ends meet as well as

[143] Gilbert Grosvenor to Bradford Washburn, 12 October, 1934, Gilbert Grosvenor files 510-1-2117 Washburn, Bradford, National Geographic Society Archives, Washington`, D.C.
[144] Bradford Washburn to Gilbert Grosvenor, 23 November, 1934, Gilbert Grosvenor files 510-1-2117 Washburn, Bradford.

studying," and although Washburn received significant research advice and financial support from Harvard's faculty, Committee on Geophysics and the Penrose Foundation, he found it "well nigh impossible to get any backing at all for an expedition into unknown country, which is led by an unknown explorer."[145]

In March of 1935, "The Conquest of Mount Crillon" was published in the *National Geographic Magazine*, Washburn's first feature article for the Society and one which brought the second-year Harvard graduate student instant acclaim and notoriety within the Society, the Geological Society of America, and Harvard's new Institute of Geographic Exploration. Washburn and Dick Goldthwait were invited to lecture at the *Royal Geographical Society* of London on the scientific and geographic accomplishments of the Crillon expeditions. Washburn had now successfully combined his talents as mountaineer, writer and photographer with those of an expedition leader, yet some detractors soon emerged.

Father Bernard Hubbard was one such critic. The "glacier priest," a cleric who has possessed an academic background in geology and numerous field expeditions to his credit, belittled Washburn's accomplishments soon after they were

---

[145] Ibid.

made public. Hubbard declared Mount Crillon to be a "lousy little mountain, one that we would take in stride on our way to something else."[146] Hubbard's motives, if not his intent, are somewhat unclear, they may, however, have stemmed from professional and academic jealousy as well as a feeling of abandonment on the part of one of his sponsors, the *National Geographic Society.* Washburn believed this, suggesting to Grosvenor that his Crillon photographs "are raising enough comment to start him {Hubbard} off on the warpath."[147] Hubbard's 1934 mapping expedition to the volcanoes of the Alaskan Peninsula was sponsored also by the Society and abbreviated account was soon after published in their magazine. We can then surmise that Hubbard perhaps envisioned that his professional accomplishments were being eclipsed by a younger explorer whose work warranted a significant portion of the magazines' March issue.[148]

Hubbard also claimed that each member of Washburn's 1934 expedition suffered severe injury, and declaring that he was "proud that no injury has ever come to any" of his

---

[146] *Champaigne-Urbana News*, 27 November 1934, p. 3. Gilbert Grosvenor file 510-1-2117 Washburn, Bradford.
[147] Bradford Washburn to Gilbert Grosvenor, 11 December 1934. Gilbert Grosvenor File 510-1-2117.
[148] National Geographic Magazine, "Father Hubbard's Alaskan Explorations," May 1934, 625-626.

expedition teams.[149] Although a few of the Crillon members experienced minor injuries, Hubbard's claims were inflated.[150] Grosvenor played the middle ground soliciting Washburn's reaction. It may have pleased Washburn to have this forum for declaring Hubbard "nothing more than an out and out headline hunter," and to call his accusations "utterly absurd." "You can judge for yourself from my pictures and my article," he suggested, "as to whether he could 'take in stride' {such difficulties as Crillon presented} on the way to the four-thousand foot hills of the Aleutians" that Hubbard had explored.[151]

Regardless, Washburn's accomplishments in Alaska were well documented and celebrated in scientific and exploration circles and placed him near to the ranks of other great American explorers such as Israel Russell, Grove Karl Gilbert, William Dall, Tarr and Martin and Admiral Byrd. The *National Geographic Society* had now added to their association a new and young explorer, proven by the hardship of remote scientific field work and able to deliver a

---

[149] Ibid.
[150] Bradford Washburn, "The Harvard-Dartmouth Mount Crillon Expedition," 54-55.
[151] Bradford Washburn to Gilbert Grosvenor, 11 December 1934. Gilbert Grosvenor files 510-1-2117 Washburn, Bradford.

product in keeping with both their traditional mission and their evolving emphasis on stirring photography.

Moreover, the *Society's* interest in Washburn's work was consistent with their underlying goal of combining entertainment and scholarship. As Lutz and Collins point out, "The *Geographic* sought, on one hand, to be a potent force in exploration and scientific research... and on the other to win the attention of large masses of people."[152] Succeeding in this would place the *Society* in a unique and powerful position to underwrite and disperse scientific knowledge allowing, as the authors argue, "the *Geographic* to speak with the voice of scientific authority."[153]

The *Society's* requirement for financial support included, above all else, significant professional accomplishments in the field and the ability to portray, both in written and photographic terms, the "romantic exploration" of remote and mysterious geographic regions.[154] Grosvenor was determined to meet the public's demand "for something that stirs the

---

[152] Catherine A. Lutz and Jane Collins, *Reading National Geographic* (Chicago: The University of Chicago Press, 1993), 24.

[153] Ibid.,

[154] Philip Pauly, "The World and All That is in It: The National Geographic Society, 1888-1918," *American Quarterly* 31, no. 4, (1979):518.

imagination."[155] Indeed, Grosvenor had positioned the *Society* to make photography its trademark and to establish photography as its principal conveyor of geographic information.[156] As a result, Grosvenor was always on the lookout for young and talented explorers who could contribute to the magazine's appeal through this format.[157]

Washburn's Alaskan photography certainly fit Grosvenor's formula. Since World War I, the *Society* had been interested in aerial photography and exploration made possible by the use of aircraft.[158] In addition to supporting Admiral Byrd's 1928-1930 aerial photographic reconnaissance in Antarctica, in 1934-1935 the *Society* sponsored a portion of Captain Albert Stevens' stratospheric flights and aerial photographic surveys.[159] As Lutz and Collins point out,

---

[155] Howard Abramson, *National Geographic: Behind America's Lens on the World* (New York: Crown Publishers, 1987), 131; see also, Gilbert Grosvenor, *The National Geographic Society and Its Magazine* (Washington, D.C.: National Geographic Society, 1957),

[156] Ibid.

[157] Ibid., 132.

[158] Ibid., 135; also quoted in David Devorkin, *Race to the Stratosphere: Manned Scientific Ballooning in America* (New York: Springer-Verlag, 1989).

[159] Ibid., 136-142. The *Geographic* supported numerous expeditions which incorporated aerial photography and surveys, See for instance, Frederick Simpich, "Skypaths Through Latin America," *National Geographic Magazine*, January 1930, 1-79; George Goddard, "The Unexplored Philippines From the Air," *National Geographic Magazine*,

throughout the 1920's and 1930's the Society adopted a "straight photography" format which captured a "literal transcription" of the subject, relegating the "presence" of the photographer secondary over the reader's interpretation of the image. By doing so, the Society forced the reader to conjure up their own feelings and perceptions of the photograph, enhancing his experience. Washburn's photographs fit this philosophy well, affording a bird's eye view of sprawling and dynamic landscapes and allowing the reader to absorb vast expanses of mountain terrain, busy in detail and gripping in aesthetic value.[160]

Bradford Washburn seized upon the Society's interests in such endeavors, knowing full well that, despite his young age of 25, he had proven himself worthy of future expeditions: "All of us here at the National Geographic Society," Grosvenor wrote, "are much impressed by your ability and success in achieving what you set out to accomplish."[161] The explorer immediately capitalized on his

---

September 1930, 311-343; Albert Stevens, "Photographing the Eclipse of 1932 From the Air: Five Miles Above the Earth Surface...," *National Geographic Magazine*, November 1932, 581-596;

[160] Catherine Lutz and Jane Collins, *Reading the National Geographic*, 29.

[161] Gilbert Grosvenor to Bradford Washburn, 6 November 1934. Gilbert Grosvenor files Yukon Expedition, National Geographic Society Archives, Washington, D.C.

achievements and enticed Grosvenor to finance an even more ambitious expedition "to the east and north of the Saint Elias Range in the Yukon Territory" in country "which has never been explored by anyone."[162]

In 1913, the International Boundary Commission had surveyed Mount Hubbard and Mount Alverstone, the peaks which delineated the boundary in this region from a distance. However, they did not attempt to explore or survey the terrain surrounding these great peaks in great detail.[163] Therefore, a void in our geographic understanding existed west of Kluane Lake, traversing the 141st Meridian to the

---

[162] Bradford Washburn to Gilbert Grosvenor, 6 November 1934, ibid.

[163] In 1906 the 141st Meridian was established as the boundary between Alaska and the Yukon. The International Boundary Commission was established and carried out expeditions to survey this region from 1906-1913. The original line of demarcation between Russian and British possessions in North America was established in 1825; see "Alaskan Boundary," *Bulletin of the American Geographical Society* 857, (June 1889):272-276. Of interest, Russian survey parties made it a practice to bury plates to confirm their discoveries. For information pertaining to this practice in Alaska, see Richard Pierce and Alexander Doll, "Alaskan Treasure: Our Search for the Russian Plates," *Alaska Journal* 1, no. 1, (1971): 2-7. For issues pertaining to the Alaska-Canada Boundary, see Thomas Hodges, *The Alaska-Canada Boundary Dispute* (Toronto: William Tyrrell and Co., 1903). For the Boundary survey of 1913 see E.C. Barnard, *Report of The International Boundary Commission* (1918), 92-101; Lewis Green, *The Boundary Hunters*, (Vancouver: University of British Columbia, 1982), 168-175.

Alsek River and further west to Yakatat Bay. This area was described by Tarr and Martin as "still largely unexplored," but where existed "an intricate system of through glaciers filling valleys and passes."[164] Washburn's objectives included a detailed mapping of this region's landscape by air and overland.[165]

Washburn's Yukon-Alaska proposal was no doubt appealing to Grosvenor, as the Society already had invested, as early as the 1890's, significant financial resources in support of geographical exploration in this general region. The young explorer brilliantly played this most appealing and romantic angle, reminding Grosvenor that "the other side of the same range of mountains was explored" by Tarr and Martin's "National Geographic Society expeditions some twenty-five years ago." Washburn proposal would provide a critically needed supplement to the Society's earliest sponsored field explorations. He believed such an expedition would powerfully "associate the Society with the opening up of this magnificent country" and with the "popular science of glacial investigation."[166]

---

[164] Lawrence Martin and Ralph Tarr, *Alaskan Glacier Studies*, 11.
[165] Bradford Washburn to Gilbert Grosvenor, 6 June 1934. Gilbert Grosvenor files Yukon Expedition.
[166] Ibid.

Washburn's formal funding request of five-thousand dollars was approved by the Society's Research Committee less than two weeks after he proposed the idea to Grosvenor.[167] He quickly assembled his team, securing the assistance of Crillon expedition members Ad Carter and Bob Bates, as well as veteran Alaskan guide, mountaineer and sourdough Andy Taylor.[168] Others members of the team included Hartness Beardley, Oma Daiber and Jack Haydon.

Throughout the remaining days of 1934 and into the new year, Washburn and the team members purchased, packed and finally shipped north to the Yukon Territory via the Panama Canal, the expedition's food and equipment supplies.[169] They planned to travel via train, ship and airplane to their base of operation in Carcross, Yukon Territory, from where they would travel via aircraft to a location in the maze of glaciers within this boundary country.

Prior to the team's departure, Grosvenor offered "a few lines of caution," to Washburn. In retrospect this seems

---

[167] Gilbert Grosvenor to Bradford Washburn, 15 November 1934. Gilbert Grosvenor files Yukon Expedition. bm
[168] Bradford Washburn to Gilbert Grosvenor, 21 November 1934. Gilbert Grosvenor files Yukon Expedition.
[169] Bradford Washburn to Gilbert Grosvenor, 3 January 1935. Gilbert Grosvenor files Yukon Expedition.

more like fatherly advice than a cursory note of concern: "Yours is the first expedition we have entrusted to a man as young as yourself," he wrote, "and your remarkable record... might very naturally lead you to be a little over-confident and take risks... that an older man might not venture to take."[170] He "emphatically" instructed Washburn to "take no chances in flying or in mountain climbing or in surveying" which may "imperil your life or the life of any member" of the team."[171]

The degree to which Grosvenor supported Washburn is evident in the letter's final sentence: "Remember that the mountains will be there next season, also the National Geographic Society, and there will be opportunities to return."[172] Indeed, Grosvenor's concern for Washburn and the expedition exceeded that of the *Society's* obvious interests in a successful campaign. He became personally involved in the endeavor, writing in advance of the expedition to representatives of Pan American Airways (contracted to support the expedition's efforts), trusting they would "take care" that Washburn be provided "SAFE" accommodation as he

[170] Gilbert Grosvenor to Bradford Washburn, 16 January 1935. Gilbert Grosvenor files Yukon Expedition.
[171] Ibid.
[172] Ibid.

"will be exploring a very difficult region where inadequate or poorly equipped planes will bring disaster."[173]

The team reached Carcross, Yukon Territory, sixty miles north of Skagway, on 25 February, 1935, a little over three months after receiving financial support from the Society. Tons of fuel, food, camp equipment, still and movie cameras, survey and mapping equipment, sledges and sled dogs were transported by airplane to this remote outpost. The following day Washburn, Andy Taylor and pilot Everett Wasson set out on the first of several aerial reconnaissance flights into the heart of the St. Elias Range. Not long after the plane reached the Range's virgin peaks, Washburn discovered and photographed "an immense glacier... finding its source right beside {Mts.} Alverstone and Hubbard and going all the way to the Alsek River...." He measured it to be nearly fifty miles in length and named his first discovery Lowell Glacier in honor of Harvard president Laurence Lowell, "who had taken great interest" in Washburn's work."[174] The Lowell Glacier, approximately one hundred and fifty miles west of Carcross, was selected as the team's base camp, from where relatively smooth sledging

---

[173] Gilbert Grosvenor to L.S. Peck, 24 January 1935, Gilbert Grosvenor files Yukon Expedition.

[174] Bradford Washburn, "National Geographic Society Yukon Expedition," TD, Bradford Washburn Collection, 7,11.

would be possible through the heart of the St. Elias Range. In addition, it afforded a pathway across the mountains to the Pacific Ocean, making a traverse of the range possible.

Investigating further the boundary peaks of Mounts Hubbard and Alverstone, Washburn found the Hubbard Glacier to extend further into the St. Elias Range than previously had been known. The glacier had been studied and photographed by Russell in 1890, Gilbert in 1899, and several Canadian Boundary survey teams in the late 1800's, as well as Tarr and Martin in the early twentieth century.[175] "In the absence of more thorough survey," Tarr and Martin wrote in 1914, "we cannot be certain of the length of the Hubbard Glacier." However, the glacier was generally accepted to be between thirty and fifty miles in length from tidewater to its hitherto unknown source deep within the St. Elias Range.[176] Although "no one has yet explored this region" in great detail, Tarr and Martin believed the Hubbard's origin lay in the vast expanse of glacial tributaries "of various sizes

---

[175] Ralph Tarr and Lawrence Martin, "Glaciers and Glaciation of Yakatat Bay, Alaska," *American Geographical Society* 38, (1906):154-155; see also, Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 109.
[176] Ibid., 104.

from Mount Hubbard, Mount Vancouver, and in the mountains beyond."[177]

Washburn's aerial survey of the Hubbard revealed that Tarr and Martin were accurate in their assessment over two decades earlier. He noted that the Hubbard Glacier passed unobstructed from Yakatat Bay "all the way through to {Mount} Logan in a ten-mile wide valley!" {original emphasis} and calculated its length to be nearly seventy miles and "probably the largest glacier on the continent."[178] It is now well documented that the Hubbard Glacier is indeed

---

[177] Although Washburn's expedition was the first to attempt a crossing of the St. Elias Range, there are reports of significant penetrations into the Range prior to 1935. See, Oscar Rohn, "Survey and Opening Up of a Military Road from Valdez to Copper Center, 1899," *Compilation of Narratives of Explorations in Alaska* (Washington, D.C.: 1900), 780-784; Ralph Tarr and Lawrence Martin, *Alaskan Glacier Studies*, 160.

[178] Bradford Washburn, "National Geographic Society Yukon Expedition," 8; Bradford Washburn to National Geographic Society, 1 March, 1935, 1-2, Gilbert Grosvenor files Yukon Expedition. The National Geographic Society immediatly touted the discovery, in particular the role aircraft were now playing in geographic discovery: "New Demonstration of the amazing part that airplanes can play in exploring unknown patches of territory... has just reached headquarters of the National Geographic Society," *Geographic New Bulletin* , Gilbert Grosvenor Files Yukon Expedition, 8 March 1935, 1.

one of the grandest and longest valley glaciers in North America, spanning over ninety miles in length.[179]

On the expedition's first photographic reconnaissance flight Washburn documented previously unknown landscape spanning an area in excess of over one thousand square miles. Subsequent photographic flights, flown at altitudes in excess of seventeen thousand feet without oxygen, uncovered four new glaciers and a previously unknown mountain range. Noting that 1935 marked the silver jubilee of the British Monarchy and Canada's status as a Commonwealth nation, Washburn named two of the more prominent peaks within the range Mt. King George and Mt. Queen Mary.[180] Washburn found both the Logan and Seward Glaciers to be connected with the Hubbard, forming one of the largest expanses of glacial ice in North

---

[179] William Field, *Mountain Glaciers of the Northern Hemisphere*, 225. It has now been established that the largest and longest glacier in North America is the Bering Glacier, located in the St. Elias Range. See Bruce Molnia and Austin Post, "Holocene History of Bering Glacier, Alaska: A Prelude to the 1993-94 Surge," *Physical Geography* 16 (March-April 1995): 87.

[180] Bradford Washburn, "National Geographic Society Yukon Expedition," 33. King George V expressed "sincere appreciation for the compliment which the National Geographic Society Yukon Expedition" bestowed upon the crown. See John Simon to Bradford Washburn, one page laminated copy of letter found in 1935 Yukon Expedition Diary , Bradford Washburn Collection, National Geographic Society Yukon Expedition, Box 2, file 1. .

America. He was intrigued by the discovery of a towering ice encrusted mountain with "terrific cliffs" which he called East Hubbard. The peak was renamed Mount Kennedy in 1964 in honor of assassinated American President John Kennedy.[181]

---

[181] In 1964, in honor of assassinated United States President John Kennedy (a long-time Washburn friend), the Canadian Government renamed the peak Mount Kennedy. The following year, Washburn returned to map and photograph for the National Geographic Society the slopes of Mount Kennedy and Mount Hubbard. For these efforts, Washburn was awarded the prestigious Burr Prize by the Society for "extraordinary achievements and contributions to geographical knowledge through your exploration of the Yukon Territory of Canada, the discovery in 1935 and subsequent naming of Mt. Kennedy and the subsequent mapping of the Mt. Kennedy" area. See, Melville Grosvenor to Bradford Washburn, 25 June 1965, Mount Kennedy files 5021.182 F-1.. During the survey expedition, Senator Robert Kennedy of Massachusetts, and the younger brother of John Kennedy, made the first ascent of the mountain. He was assisted by renowned mountaineer James Whittiker. Senator Kennedy buried in the summit's ice encrusted snow, a copy of his brother's Presidential inaugural address as well as several military medals John Kennedy received for service during World War 11. See, Bradford Washburn, "The Mapping of Mount Hubbard and Mount Kennedy, 1965," *National Geographic Society Research Reports, 1965 Projects* (Washington, D.C.: 1965; repr., Washington, D.C.: 1971), 249-277; Bradford Washburn, "Oblique Aerial Photography of the Mount Hubbard-Mount Kennedy Area on the Alaska-Yukon Border," *National Geographic Society Research Reports, 1966 Projects*, (Washington, D.C.: 1966, repr., Washington, D.C.: 1973), 283-297; see also Bradford Washburn, Robert Kennedy and James Whittaker, "Canada's Mount Kennedy," *National Geographic Magazine*, July 1965, 1-33. On the decision to include on the expedition Senator Kennedy, see Newman Bumsted to Bradford Washburn, Mount Kennedy Files 5021.182 F-1, National Geographic Society Archives, Washington, D.C.

In addition to documenting previously unknown geographic and geologic features, Washburn used the same photographs to navigate through the St. Elias Range. They were developed after each flight in Carcross where they were labeled and placed into binders for future reference. The added value of the photographs to the success of the expedition was incalculable: "Without that book," Washburn noted, "we would have been utterly lost."[182] Washburn believed that the expedition had obtained "a photographic record of peaks and glaciers whose immense size... have never been dreamed of..." by early explorers and scientists.[183]

With the aerial photographic survey now complete, Washburn joined the rest of the team on the Lowell Glacier in late March. The expedition moved steadily toward the heart of the St. Elias Range, collecting geologic samples and carrying out a very ambitious ground survey operation, occupying on 1 May, 1935 the highest survey station (12,200 feet) in Canada

---

[182] Washburn continued this practice of aerial reconnaissance and photographs in support of ground based survey and climbing efforts throughout his career. Bradford Washburn, "National Geographic Society Yukon Expedition," 39.

[183] Bradford Washburn, "National Geographic Society Yukon Expedition," 12-13; Bradford Washburn to National Geographic Society, 9 March, 1935, Gilbert Grosvenor files Yukon Expedition, 1-2.

to date.[184] On 14 May, with diminishing supplies and degrading travel conditions on the glacier prohibiting the advance of the entire team, it was decided that Washburn and Taylor would traverse the remaining portion of the St. Elias range alone. As the two headed south to Yakatat Bay via the Nunatak Fjord, the remaining team members departed east for Bates Lake, from which they would be picked up by seaplane.

Ten days later, Washburn and Taylor reached Nunatak Fjord, where they paddled an inflatable raft (which they had packed during the entire trip) along the iceberg-laden waters to Russell Fjord. After eighty-four days they arrived at the Yakatat Bay Cannery on 29 May, 1935.[185] The rest of the team was picked up from Bates Lake as planned on 7 June and flown back to Carcross, from which the expedition departed south to the states.[186]

Prior to the expedition, Washburn noted that a successful traverse through the St. Elias Range "would be some stunt if we could pull it off." Indeed, Washburn not only led the expedition safely through some of the most remote regions of North America, but he surveyed, photographed and documented

---

[184] Bradford Washburn, "National Geographic Society Yukon Expedition," 29-40.
[185] Ibid., 71.
[186] Ibid., 76.

nearly five thousand square miles of unknown territory - accomplishing perhaps one of the last grand North American geographical expeditions of the twentieth century.

In 1938, Washburn extended his (1935) photographic survey of the St. Elias Range westward under the auspices of the *National Geographic Society* and Harvard's Institute of Geographic Exploration. Dr. Rice's personal donation of five thousand dollars to "complete the aerial photographic survey of the glaciers in the Chugach Range" and certain "portions of the Wrangell Mountains," greatly enhanced the expedition's scope.[187] Washburn was particularly interested in obtaining detailed aerial photographs of the Miles, Childs and Bering Glaciers, the latter was rumored at the time to be one of the largest glaciers on the continent. Indeed, subsequent surveys of the Bering have proven it be the largest and longest glacier in North America.[188]

Washburn's photographic surveys throughout the 1930s are of particular interest to glaciolgists who continue research

---

[187] Bradford Washburn to Gilbert Grosvenor, 26 February 1938, Gilbert Grosvenor files Yukon Expedition. More will be said later in this chapter regarding Dr. Rice's role in the creation of Harvard's Institute of Geographic Exploration.
[188] See, for instance, Bruce Molnia and Austin Post, "Holocene History of Bering Glacier, Alaska: A Prelude to the 1993-1994 Surge," *Physical Geography* 16, (March-April 1995):87-92.

these features. For example, the Bering Glacier has experienced significant episodes of both retreating and advancing throughout the twentieth century. In a recent article analyzing these movements, Molnia and Post profusely illustrated their discussion with Washburn's 1938 photos of the glacier because they "provided the first complete look at the area..." and the one from which subsequent movement may be measured.[189] Thousands of square miles of unmapped country were photographed during the expedition on which Washburn discovered the Bagley Ice Field, one of the largest in North America and named in honor of Harvard colleague and pioneer Alaskan surveyor Colonel James Bagley.[190]

Throughout the winter of 1935-1936, Washburn worked under the auspices of the Harvard Institute of Geographical Exploration and the *National Geographic Society* to complete a detailed map from ground survey data and oblique aerial photographs of the area covered by the expedition. These results, which signaled a consolidated and coordinated application of Washburn's work, were sent to Albert

---

[189] Ibid., 98.

[190] Bradford Washburn to Thomas Bagley Jr., 12 July 1995; Thomas Bagely to Bradford Washburn, 30 May 1995, BWPP. Washburn and Terris Moore also made the first ascents of Mount Agnes (named by Col. James Bagley for his wife. However, as you are prohibited for naming any geographic feature after a living person, the name was changed to Mount Marcus Baker.

Bumstead, the *Society's* Chief Cartographer, for inclusion in a new-large scale map of Canada.[191] Grosvenor had planned for a special June 1936 "Canada" issue of the magazine with a feature article by Lawrence Burpee entitled "Canada's Awakening North."

However, Washburn's compelling written account of geographic discovery, complete with crisp and dramatic photographs and maps of hitherto unknown regions, took center stage as the issue's lead article.[192] Grosvenor's investment in the young explorer had paid significant dividends for the Society and forged a relationship Washburn sought with great passion and anticipation. Even prior to the departure of the Yukon Expedition, Grosvenor had offered Washburn a position at the Society. "My highest ambition," he replied "has always been to work for the Society."[193] The lure of working for Grosvenor was great, and such a position would allow Washburn the freedom and flexibility to develop and lead future geographic expeditions. Indeed, he confided in Grosvenor his fear of someday relinquishing his newly

---

[191] Bradford Washburn to Gilbert Grosvenor, 13 January, 1936, Gilbert Grosvenor files Yukon Expedition.
[192] Bradford Washburn, "Exploring Yukon's Glacial Stronghold," *National Geographic Magazine*, June 1936, 715-748.
[193] Bradford Washburn to Gilbert Grosvenor, 3 January, 1935. Gilbert Grosvenor files Yukon Expedition.

developed niche within scientific exploration: "God forbid that I should ever become a 'hard-boiled scientist.'"[194] Clearly, Washburn had no interest in the stereotyped "scientist" in the tradition of lab-oriented, white-coat clad, be speckled academician, confined to the walls of a sterile laboratory. Washburn was well at home as a field scientist, in the tradition of John Wesley Powell and Karl Grove Gilbert. He preferred the role expeditionary scientist and field geographer, alternating between the field and the lab where analysis was a part of the cycle of investigation, not the sole burden of his labor.

However, in November, 1935 Washburn accepted an instructor's position on the staff of Harvard's Institute of Geographical Exploration. This was "a grand job" he confessed to Grosvenor, and one that "I sincerely hope will give me many chances to write for the National Geographic Magazine."[195] Indeed, the position was ideal for Washburn. The Institute was founded in 1930 and was entirely funded by Dr. Hamiliton Rice, a medical doctor who had studied surveying at the Royal Geographical Society. Rice was a strong proponent of aerial mapping and played an integral part in advancing the still fledgling discipline of photogrammetry. Although

---

[194] Bradford Washburn to Gilbert Grosvenor, 20 November 1935, Gilbert Grosvenor files Yukon Expedition.
[195] Ibid.

Harvard President Lowell cared little for the development of "institutes," which he believed had the ability to create fiefdoms within academe, Rice offered substantial funding for a new interdisciplinary cooperative, a popular approach throughout the U.S. scientific community in the 1920's and 1930's.[196]

The Institute's mission reflected Rice's belief that geography and geographic exploration should take a more important role in scientific investigations, primarily in the development and training of students in the collection of geographical field data. Clearly Rice directed the Institute toward a "quantitative" geography, emphasizing aerial photography, topographical surveying and the "technical development of portable wireless apparatus for communication in the field."[197] As Washburn studied aerial photography and surveying under both Rice and Captain Stevens, it is clear to see why he incorporated so many of the Institute's technical "directives" into his field expeditions.

---

[196] Ronald E. Doel, *Solar Systems Astronomy in America: Communities, Patronage, and Interdisciplinary Science, 1920-1960*, (New York: Cambridge University Press, 1996), 6, 26-29.
[197] Harvard University, *Harvard University Handbook: An Official Guide*, (Cambridge: Harvard University Press, 1936), 82-84.

Rice forged unique cooperatives with industry, solidifying agreements with the Fairchild Aviation Company and Eastman Kodak, both whom supported field exploration. The Fairchild Company touted its support for the Institute by publishing an article on the Institute's work and the photographs of one of its brightest stars, Bradford Washburn. In detailing the Institute's outstanding faculty, the newsletter states: "Fundamentals of the various subjects are taught by... Dr. Hamilton Rice, Professor Erwin Raisz and Mr. Bradford Washburn, all of whom are men of considerable practical experience."[198]

---

[198] Fairchild Aviation News, "A Complete College Course in Aerial Photography: Institute of Geographical Exploration of Harvard University Gives Students Practical Training With Modern Fairchild Equipment," *Fairchild Aviation Incorporated*, February 1937, 1-3, Harvard University Archives, HUF 418.400, Harvard University. The creation of the Institute angered many Harvard geology faculty who believed Rice, an M.D., "bought" his rank of full Professor, also noting that such a position was to be in a discipline in which he held no academic credentials discipline. Contempt for Rice ran so deep that geology faculty members refused to allow their students to enroll in geography classes which were supported the Institute; personal communication, Bradford Washburn to Mike Sfraga, 12 September 1996. Respect for the Institute within Harvard's academic circles was less than enthusiastic. See for instance Neil Smith, "Academic War Over the Field of Geography: The Elimination of Geography at Harvard, 1947-1951," *Annals of the Association of American Geographers*, 77, no. 2 (June 1987):160-161. Throughout the later 1930's, and well into the 1940's, Harvard President James B. Conant

A PATH NOW CHOSEN

If the 1930 Mount Fairweather and 1932-34 Crillon expeditions served as Washburn's introduction to large-scale scientific exploration, the Yukon Expedition became the final stone in a foundation on which he would build his reputation as explorer, geographer, mountaineer, cartographer and photographer. Indeed, the National Geographic Society now placed him among its most celebrated explorers, declaring that Washburn's photographs "resemble those of the Antarctic taken by the Byrd Expedition."[199] Washburn firmly established the airplane and aerial photographic techniques and radio communications as viable and integral parts of Alaskan scientific exploration.

---

disdained the discipline of geography, stating that "geography is not a university subject" (Cited in Smith, "Academic War Over the Field of Geography," 159); see also, David Livingstone, *The Geographical Tradition: Episodes in the History of a Contested Enterprise*, 304-312. Conant, a champion of "pure science," found little verifiable "science" within the social sciences. See James Hershberg, *James Conant: Harvard to Hiroshima and the Making of the Nuclear Age*, (New York: Alfred Knopf, Inc., 1993), 94. Geography at Harvard was eliminated in 1948 and as a result, Hamilton Rice withdrew all funding for the Institute. See, "Dr. Rice Ends Aid to Institute At Harvard," *Boston Herald*, October 1951, p. 2; William F. Homer, "Harvard 'Unappreciative,' Dr. Rice Cancels Gift," *Boston Herald*, October 1951, p. 1, Harvard University Archives, HUF 418.400, Harvard University.

[199] "Geographic News Bulletin," *National Geographic Society*, 28 June, 1935.

Washburn's interdisciplinary framework for scientific investigation and exploration was recognized internationally as he received the prestigious Cuthbert Peak Award of the Royal Geographical Society of London as well as accolades from Lord Tweesdsmore (John Buchan), Governor General of Canada who declared "how extraordinarily good this type of young American is! - pioneering in the Mount St. Elias range in Alaska."[200]

In June of 1935, just as the Yukon expedition came to a close, glaciologist Walter Wood, under the auspices of the American Geographical Society, utilized many of Washburn's field techniques in his research within the glaciated mountains of the Yukon Territory. Wood was particular interested in obtaining and utilizing aerial oblique photographs in the production of topographic maps.[201] The spring and summer of 1935 signaled a new era in Alaskan exploration that witnessed the continued introduction of new and emerging fields and technologies such as photogrammetry

---

200 Janet Adam Smith, *John Buchan* (London: Rupert Hart-Davis, 1965), 407.
201 Walter Wood, "The Wood Yukon Expedition of 1935: An Experiment in Photographic Mapping," *Geographical Review* 26 (1936): 228-46.

and the utilization of photographs in the production of maps.[202]

It was not until after World War II, a full decade following Washburn's Alaska expeditions, with all of its innovation and success, that large-scale, multi-year research glacier studies were undertaken. Most notably was that of Maynard Miller and William Latady. It was directed be William Field, who established in 1948 the Juneau Ice Field Research Project or JIRP, an ambitious glacial research station under the auspices of the American Geographical Society.[203] Technology in the hands of a few young intrepid explorers now provided a pathway for intensive scientific studies previously unexplored regions of Alaska. And Washburn, at

---

202 The Department of Technical Training of the American Geographical Society had first introduced this technique in Labrador. See, Alexander Forbes, "Surveying in Northern Labrador," *Geographical Review* 22 (1932): 30-60; Alexander Forbes "A Flight to Cape Chidley, 1935," *Geographical Review* 26 (1936): 48-58.

203 Maynard Miller, *Progress Report of the Juneau Ice Field Research Project* (New York: American Geographical Society, (1949). JIRP is still in operation today, having trained scores of professional glaciologists, the results of which can be seen in a plethora of published research accounts and substantial financial support for graduate student research. Over the years, JIRP has extensively utilized aerial transport and photography, as well as the most advanced scientific equipment.

the age of twenty-five, had established himself as one of the founding fathers of this new age.

Although Bradford Washburn's many geographic discoveries, survey work and first ascents all are important in terms of Alaska exploration, they are eclipsed by the scientific significance inherent in the thousands of aerial photographs he obtained. This contribution to geology is immeasurable because the photographs are as scientifically and aesthetically valuable today as they were six decades ago. Washburn's artistic eye enabled him to more easily identify the mountain landscape which enhanced his ability to uncover previously unknown geographic features. This artistry, when coupled with his academic training in geology made it possible for Washburn to identify and photograph from the air fundamental principles in glacial geology. These photographs have been used in hundreds of academic texts, journals, technical manuals and popular writings. They continue to afford classroom instructors a powerful tool from which glacial features can be identified and interpreted and they provide the trained geologist with the means by which complex research problems and investigations may be illustrated. For example, a photograph of the Woodworth Glacier, Alaska, shows glaciofluvial fans, eskers, evasion modes, subglacial floors and proglacial lakes, which spurred renowned American glaciologist Robert Sharp in 1988 to declare the image a "veritable textbook of glacial features.[204] Indeed, Washburn believes his photographs to be "the real scientific contribution" of his exploration, "illustrating fundamental principles of glacial geology."[205]

By the late 1930's, Washburn had established himself as an intrepid mountaineer and explorer, cartographer and, perhaps above all else, a master photographer.[206] Subsequent Alaskan

---

[204] Robert Sharp, *Living Ice*, 151. Washburn's photographs are used throughout this text, see for instance, pages 31, 38, 72,116, 137,142. Thousands of Washburn's 'technical" photographs have been published over the decades in hundreds of books, journals and popular accounts. See for instance, John Shelton, *Geology Illustrated* (San Francisco: W.H. Freeman and Company, 1966), 211, 216-218,223, 226; James L. Dyson, *The World of Ice*, (New York: Alfred A. Knopf, 1962), plates V, XIV, XV, XVII, XX; Robert Sharp, *Glaciers*, 12, 64; Clyde Wahrhaftig, "The Alaska Range," Howell William, ed, Landscapes of Alaska: Their Geological Evolution, (Berkeley: University of California Press, 1958),Plate 1.

[205] Bradford Washburn, "A Preliminary Report on Studies of the Mountains and Glaciers of Alaska," *The Geographical Journal*, 222. Noted geologist Dr. Troy Pewe' believes Washburn's photographs provide an invaluable record of Alaska's glaciers from which their movement may be studied, Troy Pewe', telephone interview with Mike Sfraga, Tucson, Arizona, 28 January 1996.

[206] Due to his extensive experience in employing radio communications with the airplane, Washburn was invited by his publisher George Putnam in 1936 to interview for the position of navigator on Amelia Earhart's round-the world flight the following year. Putnam, Earhart's husband, believed Washburn's experience in Alaska would be of benefit to Earhart, yet Washburn withdrew his name because of the

first ascents on Mount Lucania (17,150 feet) in 1937, Mount Sanford (16,250 feet) and Mount Marcus Baker (13,250 feet) in 1938 accentuated his mountaineering prowess. The Boston press had followed each of Washburn's Alaskan exploits closely, providing to the public a detailed account of his expeditions, and underscoring his "can do" and "will do" attitudes as well. He rose to a prominent "Boston's son" status, and in 1938 was offered the now vacant position of Director of the New England Museum of Natural History (now the Museum of Science in Boston). We will soon see that this opportunity would play a critical and pivotal role in Washburn's subsequent career path.

The Museum, founded in 1864 and is one of the oldest natural history museums in the world, was a financially beleaguered and rather static institution.[207] John K. Howard, President of the Museum, saw Washburn as a man with boundless energy and fortitude and the ability to lead the Museum forward. He put a "hard sell" on Washburn, declaring: "We need you. We need you desperately."[208] Washburn accepted the position the

---

lack of "adequate radio for the Pacific legs of the flight." Bradford Washburn, interview with Mike Sfraga, 18 June 1992, Tape recording, Cambridge, Massachusetts.

[207] Mary Desmond Rock, *Museum of Science, Boston: The Founding Formative Years, The Washburn Era 1939-1980*, 2.

[208] Ibid., 20.

following year. In retrospect, this was his first and only "steady job," and he held it from 1939-1981.[209]

The relationship was symbiotic. The additional income (three thousand dollars per year) supplemented his proceeds from public lectures and the Museum benefited by its association with Washburn and from his subsequent expeditions. From that time forward, Washburn's every success and honor reflected on the Museum and generated the prestige and public recognition it needed. Eventually, this relationship, which spanned nearly forty years, resulted in tens of millions of dollars in private and corporate support which allowed for the transformation of the "old" pre-twentieth century institution into a vibrant, twenty-first century interactive, "cutting edge" Museum of Science.[210]

As the 1930's came to a close, Bradford Washburn, Harvard graduate, explorer and now museum director, had solidified his place in American explorations circles. His ability to

---

[209] *Cambridge Tribune*, "Bradford Washburn Appointed Head of Natural History Museum," 3 March 1939. Bradford Washburn in Honorary Director of Boston's Museum of Science.

[210] In 1949 a new location along Boston's Charles River was purchased for a new Museum facility. The New England Museum of Natural History was relocated to "Science Park" and its name changed to Boston's Museum of Science. See, Mary Desmond Rock, *Museum of Science, Boston: The Founding Formative Years, the Washburn Era, 1939-1980*, 55.

organize and obtain significant financial support for scientific expeditions in remote regions of North America, from which rich geographic and geological data were attained, was well documented. He had learned well from his mentors, Hamiltion Rice and Captain Stevens, the techniques of aerial photography and photogrammetry and found himself not only the continuing student but the instructor in such disciplines. Washburn's relationship with the *National Geographic Society* supplied the needed funding to pursue his interests and afforded the *Society* the benefit of his accomplishments. Thus, his work was seen and indeed celebrated wherever the *Society's* magazine was read. Washburn, now 27 years old, had become one of America's most celebrated explorers and his career had just begun.

Washburn assumed the museum's directorship on the first of March 1939 and assumed his duties with same energy an dedication he exhibited in the field.[211] One of Washburn's first tasks was to oversee the hiring of a personal secretary, for which he selected a young and strikingly good looking Smith College graduate, Barbara Teel Polk. The following year, in April of 1940, Barbara Polk became Mrs.

---

[211] Mary Desmond Rock, *Museum of Science, Boston: The Founding and Formative Years, the Washburn Era 1939-1980*, 23. Washburn retained his position of Instructor of Geography at Harvard until the outbreak of World War II.

Bradford Washburn and the couple spent their summer honeymoon on the slopes of Southeast Alaska's Mount Bertha, an unclimbed peak 10,182 foot tall. Without any mountaineering experience she scaled the peak in fine fashion. By doing so she became the first woman in nearly thirty years to reach the summit of an Alaskan peak.[212] The couple returned to Alaska the following summer where they made the first ascent of Mt. Hayes (13,740 feet) in the Alaska Range.[213]

Washburn occupied his initial years at the museum with touring and studying museums throughout the United States, from which he developed a master plan to revitalize the old New England institution. However, his efforts were cut short in late 1941 by America's entry into the Second World War. Washburn and other distinguished mountaineers and polar explorers were called upon to serve the United States in the development of cold weather equipment for U.S. troops who now were preparing to fight in remote regions similar to

---

[212] "The First Woman to Climb Difficult Mt. Bertha, Alaska," *The Illustrated London News*, 16 August 1941, p. 217-218. In 1912 Dora Keen scaled Mt. Blackburn (16,286 feet), the highest point in the Wrangell Mountains. For an abbreviated discussion and reflection of this climb, see Editors note, "Mountain Climbing in Alaska: The First Expedition to Mt. Blackburn," *Appalachia* , 15 June 1995, 87-89.
[213] Bradford Washburn, "The First Ascent of Mount Hayes," *The Backlog* 18, no. 4, December 1941, 3-7.

those he and his contemporaries had previously explored. Their expertise would become the cornerstone of U.S. efforts to hastily prepare and protect American soldiers in these little understood environments. As we will see, Washburn's role would be crucial in the military's clothing efforts and his service would lead him back to Alaska on several wartime expeditions. On three particular occasions, Washburn led field tests of winter clothing and equipment throughout the Mount McKinley region. These expedition provided the opportunity to explore the mountain and fostered a foundation from which his life-long relationship with Mount McKinley soon would emerge.

CHAPTER 3

AMERICA'S FIRST "COLD WAR"

LESSONS LEARNED

Bradford Washburn's service as a civilian consultant to the Army Air Force throughout the Second World War had an indelible impact upon his life. This chapter will illuminate Washburn's participation in several military field-test expeditions in Alaska, and the importance of these developments in solidifying his scientific interest in the Mount McKinley region. Throughout the war Washburn played a critical role in the development of cold weather clothing and equipment for Air Force personnel. These efforts, often draped in conflict, also provide valuable insight into his personality -- and afford a unique window through which we may appreciate his many contributions to the understanding of the McKinley area and the motivating factors which spurred his investigations.

Therefore, this chapter deviates somewhat from expeditionary science and geographic discovery. It discusses, in broad context, efforts made by the U.S. military throughout the war to address serious shortcomings in cold weather equipment development and supply. More specifically, it will focus on Washburn's considerable role within these broader and more complex issues. The additional themes are important because they provide the foundation for Washburn's subsequent investigation of the Mount McKinley region -- the subject of the next chapter.

At the outbreak of World War II, the United States was ill prepared to engage in a global conflict. The world's inhospitable regions presented military planners with the daunting challenge of how to provide their troops with clothing and equipment capable of protecting them in deserts, rain forests and polar regions.[1] In order to appreciate the significance of Washburn's work in this effort, and to provide context for it, a brief discussion is warranted on the devastating effect cold and inadequate clothing had on those engaged in military campaigns prior to World War II.

The problems of cold weather warfare during winter months in high latitudes and mountainous regions have, over the

---

[1] For a discussion of military attempts to better train and equip U.S. servicemen in diverse environments, see James Phinney Baxter 3rd, *Scientists Against Time* (Cambridge: The M.I.T. Press, 1952).

centuries, frustrated military planners plagued combatants. The lack of understanding regarding the environment in which military campaigns have been carried out, inadequate understanding of human response to cold, inferior clothing and lack of significant research and development programs have all contributed to the considerable human toll taken by winter and mountain campaigns.[2]

Prior to World War II, the United States had limited experience with cold weather warfare. However, there existed numerous accounts of the adverse effects of cold weather on previous military efforts. Cold weather injuries (frostbite, hypothermia and death) were experienced by the armies of Alexander of Macedon and later by Greek soldiers fighting in Armenia during the third and fourth centuries B.C.[3] General George Washington's troops at Valley Forge suffered terribly throughout the later eighteenth century from

---

[2] For a much broader discussion of this and related issues pertaining to the role of environment upon human mortality, see William McNeill, *Plagues and People* (Garden City: Anchor Press, 1976).

[3] T.V. Ariev, "Fundamental Outlines of Present Day Knowledge of Frostbite," trans. and ed. Earl R. Hope, *Frostbite* (Ottawa: Earl R. Hope, 1950). See also, H.W. Grattan, "Trench Foot," in *History of the Great War Based on Official Documents* (London: His Majesty's Stationary Office, 1922), 169-177. It has been reported that approximately 10,000 Greek soldiers suffered "mass freezing" in the mountains of Armenia while retreating from Babylon to the Black Sea.

inadequate cold weather clothing and exposure to the damp and cold winter conditions along the Eastern Seaboard.[4] Similarly, Napoleon's Grand Army suffered extraordinary losses in temperatures as low as -30 degrees Celsius while in retreat from Russia to France in 1812-1813. Larrey, Napoleon's field surgeon, documented the torment of the retreat noting inadequate shelter, food supplies and lack of any adequate winter clothing at all. Russian soldiers were "freezing during every bivouac," Larrey observed, causing them to loose "equilibrium and fall into the snow-filled ditches alongside the Russian roads." Here, the men experienced "painful stiffness... followed by paralysis... prior to death which followed quickly." He estimated that of the nearly eighty-thousand troops who began the retreat, just over half reached the Russian border and of these, a fraction returned safely to France.[5]

Injury and death associated with cold weather also was reported during the Crimean War of 1854-1856, in the twentieth century during the Russo-Japanese War, in the

[4] James Thatcher, *Military Journal of the American Revolution* (Hartford: Hurlbert William and Co., 1862), 127, 188.

[5] Larrey, *Memories d'un Chirurgien Milit. et de Campagne*, quoted in Hans Killiam, *Cold Injuries With Special Reference to German Experience During World War II* (Washington, D.C.: United States Navy, 1952), 1-2.

Balkan War of 1912-1914 and in World War I.[6] A striking number of British troops fell prey to frostbite in World War I due to inadequate cold weather foot wear. Over one-hundred thousand cases of frostbite and trench foot were treated during the course of the war, with the vast majority of these injuries occurring within the first two years of the war. The British military appeared to have learned little from their experiences during the Crimean War.[7] In contrast, United States Expeditionary Forces in Europe experienced significantly less frostbite and trench foot injury (approximately two thousand documented cases), due in part to the fact that U.S. soldiers had better protective clothing.[8] Subsequently, little concern and, therefore, limited emphasis on the part of U.S. military planners was placed upon the development of cold weather equipment and logistics.

---

[6] *Medical and Surgical History of the British Army During War Against Russia in Years 1854-56* (London: His Majesty's Stationary Office, 1858), vol. 2; W.H. MacPherson, "The Russo-Japanese War," in *Medical and Sanitary Reports from Officers Attached to the Japanese Forces in the Field* (London: His Majesty's Stationary Office, 1908), 242; C.M. Page, "Gangrene in War," *British Medical Journal* 2 (August 1914): 386-388.
[7] Tom Whayne and Michael DeBakey, *Cold Injury, Ground Type* (Washington D.C.: Government Printing Office, 1958), 43.
[8] Ibid., 47. American Expeditionary Forces served also in Siberia, utilizing clothing in use at the time at a number of Alaskan military garrisons. Other U.S. forces within Russia relied upon equipment supplied by the British.

With the outbreak of the Second World War, the United States became increasingly uneasy about its capacity to wage a global war. In addition to inadequate stockpiles of munitions and basic equipment needed to sustain a competitive military force, the United States realized significant deficiencies in its ability to develop, procure and disseminate cold weather clothing and equipment. These concerns were underscored in the winter of 1939 with the invasion of Finland by Russia. The "Winter War," as it came to be known, brought to the forefront the importance of a well-equipped army capable of carrying out extended military campaigns in harsh environmental conditions.[9]

In the latter part of 1939, the Soviet Union was convinced that a German invasion of Russia was inevitable. It would begin along the Russian-Finnish border and come through Finland. Therefore, the Russian government sought to annex a forty-five mile "buffer zone" of Finnish border country on

---

[9] For additional sources related to the Winter War, see Allen F. Chew, *The White Death: The Epic of the Soviet-Finnish Winter War* (East Lansing: Michigan State University Press, 1971); Aleksander Moiseevich, June 22, 1941: *Soviet Historians and the German Invasion*, trans. and ed., Vladimar Petrov (Coluimbia: University of South Carolina Press, 1968); Olin Ulkoministerina Talvisodan Aikana, trans., Vaino ALfred Tanner, *The Winter War: Finland Against Russia, 1939-1940* (Stanford: Stanford University Press, 1957).

which such an invasion would be met and where, as one Russian official declared, "the main battle would be fought."[10] Citing their stated neutrality in the unfolding war (as did Norway and Sweden), the Finns refused to negotiate further with the Russians for the creation of such a zone. On 26 November, 1939, nearly one million Russian troops supported by hundreds of aircraft invaded Finland which was defended by a mere three-hundred thousand Finnish soldiers, eighty percent of whom were reserve forces.[11]

The initial battle could be likened to a classic David and Goliath confrontation. Vast columns of Russian troops and mechanized vehicles poured across the border. Yet, the outnumbered Finnish army relied on knowledge of their country and their ability to travel through the snow-clad terrain. This countered the Soviet advance which was itself hindered by an inability to navigate their mechanized columns through deep snow and rough terrain. The Finns, clad in white parkas and traveling quietly and quickly on skis, conducted an efficient Arctic version of guerrilla warfare. This forced the Russians to consolidate their resources along the region's limited road system making them

---

[10] Eloise Engle and Lauri Paananen, *The Winter War: The Soviet Attack of Finland 1939-1940* (New York: Stackpole Books, 1992), 9, 8.
[11] Ibid., 4.

relatively easy prey. "If an approaching armored enemy column could be halted," historian Barry Gregory noted , "Finnish troops moving swiftly across the wilderness could strike at the flanks and rear" of the force. Thus, the Finns capitalized on their limited numbers by utilizing an efficient system of transportation in remote regions to compensate for the Soviet's military superiority.[12]

In addition to difficulties with the Finn's unconventional approach to warfare, the Russian army was overwhelmed by Arctic temperatures reaching as low as minus forty degrees Celsius. Russian troops were equipped only with standard summer weight underwear, socks and lightweight trousers, which afforded little protection from the cold. Additionally, Soviet tents, designed for warmer climates, did not provide sufficient insulation against the Arctic environment. As a result, untold numbers of lost toes and

---

[12] Barry Gregory, *Mountain and Arctic Warfare: From Alexander to Afghanistan* (Wellingborough: The Bath Press, 1988), 102. The Finns employed several tactics devised to attack specific, limited targets by means of swift movement. "*Sissi*" combat relied on surprise attack, in a very limited area with hit and run tactics. "*Motti*" tactics relied on small teams of troopers surrounding the unsuspecting enemy an enclosing them in ring of gun fire. In both cases, Finnish troops relied heavily on their ability to move about in relatively small numbers and utilizing the environment as an alley. See Center for Military History, *Effects of Climate on Combat in European Russia* (Washington, D.C.: Government Printing Office, 1952), 65.

fingers from frostbite and many simply froze to death.[13] The Soviet troubles were compounded due to their reliance on mechanized support for transportation and fire power. The inability of this equipment to function at extreme temperatures made them virtually useless. Motor oil and other lubricants froze, batteries died, fuel lines cracked and engines stopped running. The Soviet war machine sat idle at times, an easy target for the elusive Finnish sharpshooters who darted in and out of surrounding forests, picking off cold and hungry Russian troops. In contrast, the Finns relied on skis to move about the terrain and employed a layered system of dressing which optimized body heat. The typical Finnish trooper wore heavy underwear, a wool sweater and trousers, and field jacket over which a white parka served as an effective camouflage covering.[14]

Despite the gallant efforts of the Finnish army, the Soviet forces in the spring of 1940 defeated what remained of the resistance. However, the Finnish troops had embarrassed a furious Stalin who raged to Nikita Khruschev that even though "Many bridges have been destroyed. Many trains have been crippled..." the Finns fight on with "only their skis

[13] Engle and Paananen, *The Winter War: The Soviet Attack of Finland 1939-1940*, 43.
[14] Barry Gregory, *Mountain and Arctic Warfare: From Alexander to Afghanistan*, 102.

left." To Khruschev, it seemed the Finn's supply of skis would "never run out." It was infuriating that these skirmishes continued resulting in a high loss of Russian lives in respect to a relatively small numbers of Finnish troops.[15] The Soviet debacle in Finland demonstrated that the military might of even the greatest nations could not withstand the forces of nature - climate and elements for which they were not prepared. With this realization, United States military leaders endorsed plans for diligent research and development of cold weather equipment in hopes of avoiding the mistakes made by their Russian counterparts.[16]

Historically, U.S. interest in military cold weather gear was minimal. For the most part, it was limited ensuring warm clothing for garrisons in places such as the North Atlantic and Alaska. The United States Army had had experience in Alaska subsequent to its purchase from Russia in 1867. Although the U.S. military presence there dwindled over the following two decades, boundary disputes between the U.S. and Canada and the discovery of gold in 1897, resulted in a

---

[15] Nikita Khruschev, quoted in Engle and Pannnanen, *The Winter War: The Soviet Attack of Finland 1939-1940*, 122.
[16] Robert Bates, interview with Mike Sfraga, Tape recording, Exeter, New Hampshire, 15 July 1992.

permanent U.S. military force in the region.[17] During the first three decades of the twentieth century, military responsibility in the Territory ranged from building and maintaining road systems to the construction and operations of vital communication links (WAMCATS) between Alaska and the continental United States.[18] Thus, the U.S. military had extensive non combat-related experience in harsh, remote and cold regions. Even then, however, equipment, clothing and living conditions for the men were simply not adequate.[19]

Overall, U.S. military planning prior to the Russian invasion of Finland was defensive. It was built upon the premise that future military engagements would take place near or within the continental United States or in relatively mild climates. Little substantive research and development in Arctic, mountain or desert clothing and equipment had been undertaken.[20]

---

[17] Public Information Officer Headquarters, *The Army's Role in the Building of Alaska* (Seattle: Headquarters United States Army, Alaska, 1969), 26-40.

[18] Jonathan Nielson, *An Interpretive Survey of Alaska's Military Heritage: 1867-1980* (Alaska: Alaska Historical Commission, 1980),6, 90. The acronym WAMCATS was used to describe the Washington-Alaska Military Communications and Telegraph System.

[19] Ibid., 84-85.

[20] Thomas Pitkin, *Quartermaster Equipment for Special Forces* (Washington, D.C.: Quartermaster Corps Historical Studies, 1944), 1.

During the first World War, existing cold weather equipment was alarmingly limited. In Alaska, these deficiencies were augmented by indigenous clothing techniques and materials including moose hide moccasins, horsehide gauntlets, mittens, pants and parkas made from duck, and muskrat fur caps which, as the military regulations emphasized, needed to be "thoroughly dressed with butter or oleomargarine, and cleaned with sawdust."[21] Such materials supplied a rather small and relatively stationary military force. This was consistent with the army's plans of limited troop movement and deployment in harsh environments.[22] However, Alaskan military officers met at Chilkoot Barracks in the mid to late 1930's to discuss and recommend new items of winter equipage, the results of which provided the foundation for future research and development.[23]

As a result of these meetings, enhancements were made to the soldier's winter wardrobe by 1940. Yet Alaskan troops were still afforded only limited protection from the elements. Burlap boot socks, dried grass soles and "Eskimo" mukluks

---

[21] War Department: Quartermaster Corps, *Specifications No. 1171 for Alaskan Clothing* (Washington, D.C.: Government Printing Office, 1914), 3-11.
[22] Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 1.
[23] Ibid., 9.

fashioned out of reindeer skin and fitted with soles constructed from "rawhide made from bearded seal" constituted regulation footwear. At the time of the United States entry into World War II, the military's standard cold weather manual included only a cursory description of winter equipment and a superficial discussion of preventative measures for warding off cold weather injury.[24]

It was painfully obvious to military planners that America's understanding and resources were inadequate for proper preparation for a global conflict. William House, noted American mountaineer and special military consultant for cold weather equipment during the war, found the U.S. situation to be "desperately lacking" as the country's fighting men had "neither equipment nor tactical understanding to function in extreme conditions." House contended that "lessons on cold weather problems learned in the First World War were forgotten and were not available when the need arose."[25]

---

[24] War Department, *Basic Field Manual: Operations in Snow and Extreme Cold* (Washington, D.C.: Government Printing Office, 1941), 4-10. The manual does, however, provide a detailed discussion by Dr. Vilhalmur Stefansson on the construction of domed snow houses and Nordic ski techniques.
[25] William House, "Mountain Equipment for the U.S. Army," *American Alpine Journal*, (1946): 225.

In the waning months of 1941, the United States was precariously situated between two inevitable theaters of war. Hitler's Germany continued its onslaught throughout the European continent and set the stage for U.S involvement across the Atlantic. Simultaneously, the war of words and threats of economic isolation and retaliation between the United States and the Empire of Japan signaled the impending conflict which would soon erupt in the Pacific.[26] As the geopolitical environment deteriorated, U.S. Secretary of War Henry Stimson summoned the combined expertise of members of the American Alpine Club, the National Ski Patrol and scores of civilian cold weather experts to assist in a complete review of Arctic and mountaineering equipage. Stimson knew well the tactical advantages Italian and certain German mountain troops had enjoyed in World War I and was determined to adequately train and supply U.S. troops for such an environment.[27]

---

[26] Historical sources on Franklin D. Roosevelt and the United States' entry into World War II are vast; for an introduction to the literature see Robert Dallek, *Franklin D. Roosevelt and American Foreign Policy, 1932-1945* (New York: Oxford University Press, 1981); William E. Leuchtenburn, *Franklin D. Roosevelt and the New Deal: 1932-1940* (New York: Harper & Row, 1963).

[27] Terris Moore, interview with Mike Sfraga, Tape recording, Cambridge, Massachusetts, 15 January 1993. For additional information on Henry Stimson, see, for instance Elting Elmore Morison, *Turmoil and Tradition; A Study of the Life and Times of Henry L. Stimson* (Boston: Houghton Mifflin, 1960).

Subsequently, a subsection for research and development of Arctic and mountain equipment was established. At a time just following the Japanese bombing of Pearl Harbor, the Clothing and Equipage Branch was created within the supply division of the Quartermaster Corps to begin a vigorous program to evaluate the military's capability and needs.[28] Robert Bates, noted American mountaineer and explorer, was recruited by this branch to assist in the planning, designing and developing of "completely new functional equipment for the Army's prospective mountain divisions." The Branch was to consider the needs of troops in "Iceland and Greenland and for such requirements in Arctic and cold weather warfare as might develop."[29] Bates found the task

---

[28] The Quartermaster Corps will hereafter be referred to as QMC. These efforts were among dozens of research programs launched by the Government at this time. See, for instance Larry Owens, "The Counterproductive Management of Science in the Second World War: Vannevar Bush and the Office of Scientific Research and Development," *Business History Review* 68, no. 4 (Winter 1994): 515-576. There is a general void yet to be filled in the literature pertaining to the importance and role of the OSRD. Owens points out that "OSRD has not attracted the attention it deserves despite a growing volume of studies of wartime and Cold War Science." Ibid., 516-517.

[29] William House, "Mountain Equipment for the U.S. Army," 226. Robert Bates was a member of numerous expeditions to Alaska under the direction of Bradford Washburn and included Mount Crillon in 1933, the 1935 National Geographic Society's Yukon Expedition and the first ascent of Mount Lucania in 1937.

most challenging as "no one knew how to design this type of material or... why there were people who could tell you manufacturing costs but no experts to tell you the {clothing} specs."[30]

The Clothing and Equipage Branch was eventually renamed the Special Forces Section and was divided into specific research areas as mountain, Arctic, jungle and desert warfare.[31] Concurrently, Simon Buckner, Commander of the Alaska Defense Command, expressed "alarming" concern regarding the lack of adequate clothing and equipment for the simple day-to-day functions of Alaskan troops. As Bates points out, General Buckner convinced the Quartermaster to investigate "simple items" for use by troops in Alaska, "such as big coats, boots, parkas and sweaters." Bates explains that such efforts provided the catalyst and foundation for research and development of "skis and ice axes and pitons" and a full range of mountain and Arctic gear.[32]

---

[30] Robert Bates, Interview with Mike Sfraga, Tape recording, Exeter, New Hampshire, 15 July 1992.
[31] Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 3.
[32] Robert Bates, interview with Mike Sfraga, Tape recording, Exeter, New Hampshire, 15 July 1992.

THE "COLD WAR" ON THE HOME FRONT

On December 7, 1941, the United States was catapulted into the Second World War when the Japanese Imperial Air Force dealt a swift and devastating blow to the U.S. Pacific Naval Fleet at Pearl Harbor, Hawaii. Just four days later, Germany and Italy declared war on the United States which quickly reciprocated the action.[33] With war raging across both oceans, efforts were intensified to procure adequate cold weather equipment. However, the United States was not the only nation in need winter clothing. German troops, stationed in Russian during the winter of 1941-1942, had little in the way of adequate cold weather clothing as well. To underscore this point, one need only consider the fate of the members of a single German Panzer Division, inadequately clothed during a January cold snap, who experienced nearly eight hundred cases of frostbite a day.[34]

Aware of the valuable expertise that existed in Europe regarding mountain warfare and clothing (even though most

---

[33] William Langer and S. Everett Gleason, *The Undeclared War* (New York: Harper and Brothers Publishing, 1953), 31. The 1940 Tripartite Agreement signed by Japan, Germany and Italy mandated the declaration of war against the U.S. by the latter two nations.
[34] Center for Military History, *Effects of Climate on Combat in European Russia*, 18.

had been forgotten in the inter-war years), the U.S government enlisted the services of H. Adams Carter, veteran mountaineer and foreign language expert, to serve as a civilian advisor in the military's G-3 Division (Operations and Training). Carter's work included the translation and interpretation of scores of European documents pertaining to mountain warfare tactics and equipage. Carter also interviewed former mountain troops living in the States who "gave valuable first-hand information."[35]

With a new and significant research now in place, the military turned to the collective expertise of leading authorities in cold region exploration and survival. Robert Bates and Colonel L.O. Grice, Chief of the Standardized Branch of the QMC, assembled a most impressive board of advisors who were to pay close attention to the "practicability of the development, manufacturing, transport and dissemination of equipment to the field."[36]

---

[35] H. Adams Carter, "Mountain Intelligence," *American Alpine Journal* , (1946): 245.
[36] Terris Moore, interview with Mike Sfraga, Tape recording, Cambridge, Massachusetts, 15 January 1993. As author Ben Read suggests, Terris Moore had "forgotten more about Alaska's mountains than most of us will ever be privileged to learn." See Ben Read, "An Interview with Bradford Washburn and Terris Moore," *Climbing* , April 1993, 16.

Other advisors included polar explorers Vilhalmur Stefansson and Sir Hubert Wilkens who were called upon for their expertise in polar travel and survival. Outdoorsman and clothing manufacturer Leon Leonwood Bean (founder of L.L. Bean) reviewed the military's development, production and dissemination of all outdoor equipment, yet was particularly interested in foot wear.[37] Mountaineer and explorer Bradford Washburn, who would play a critical role in such work and whose experience leading expeditions to remote regions of Alaska was recognized, served as an expert consultant to the U.S. Army Air Force.

Throughout the winter and spring of 1941-1942, the Quartermaster Corps engaged in a massive effort to evaluate the effectiveness, functionality and durability of the vast majority of winter equipment within its stockpile. The QMC's advisors brought to this work personal expertise and biases, advocating for equipment and clothing designs each considered most effective. Time constraints, limited production capability and the scarcity of many materials created a challenging and dynamic forum for discussion.[38]

---

[37] M.R. Montgomery, *In Search of L.L. Bean* (Boston: Little, Brown & Company, 1984), 24-25.
[38] For a discussion of problems associated with limited materials with which to develop adequate military clothing, see Erna Risch, *U.S. Army in World War II, The Quartermaster*

"When you add personal prejudices and idiosyncrasies with the added problem of military requirements," stated William House, "you create a field for discussion even more than usually conducive to difference of opinion."[39] Debate ranged from the type of boot one could use in an Arctic setting to the most versatile outer garments suitable for mountain warfare.

An example of the diverse opinions of and the problems encountered by the QMC group is evident in the spirited discussions which occurred regarding the development of a basic outer layer of cold weather clothing. Stefansson had long advocated to polar explorers the notion that one must adapt to the Arctic environment by employing clothing and hunting strategies widely used by Polar Eskimos.[40] Therefore, he advocated strongly for the use of igloos rather than tents and natural furs in place of manufactured materials as outer protective garments. He suggested the calculated slaughter of tens of thousands of caribou by

---

Corps: Organization, Supply and Services, vol. 1 (Washington, D.C.: Government Printing Office, 1953), 58-74.
[39] William House, "Mountain Equipment for the U.S. Army," 225.
[40] Stefansson details his theories regarding the Arctic in *The Friendly Arctic* (New York: The MacMillan Company, 1943.

military aircraft, from which superior cold weather clothing could be fashioned from their hides.[41]

Stefansson's idea was quickly squelched by Bean, who contended that the logistics and subsequent manufacturing of hides was impractical on such a grand scale. Thus, the QMC spared one of the continent's northern ungulate populations.[42] The significant supply of winter equipment which the U.S. would need to outfit its soldiers eliminated from consideration the use of most traditional furs. The military concentrated its research and development efforts on substitutes, such as synthetic garments made of pile, and looked to innovative means to enhance design and production of hundreds of new items.[43]

Compounding the problems of manufacturing, the military was faced with the daunting task of outfitting an entire Army for warfare in literally any part of the globe. As William House explains, many question were asked in order to properly plan future research and development: "Would American troops be involved in the mountains of Greenland or

---

[41] Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, June 18 1992.
[42] Robert Bates, interview with Mike Sfraga, Tape recording, Exeter, New Hampshire, 15 July 1992.
[43] Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 5.

Iceland, the Pyrenees, Norway, the Alps, the Caucasus, even the Himalayas?" House recalled that the planners struggled to conceive of a "single mountaineering kit which would be usable in any mountain range" in the world.[44] Furthermore, the nature of warfare dictated that a soldier's equipment and clothing be as lightweight as possible. Therefore, newly developed gear needed to be lightweight and versatile while providing sufficient protection in a harsh and still little understood environment.

Each branch of the military had its own unique set of clothing and equipment needs. The Army Air Corps employed numerous experts to review, design and test equipment specifically tailored to the airman's needs. As noted, Bradford Washburn was one such advisor, contributing his unique expertise in a number of areas including cold weather survival and in the use of planes in remote and frigid environments. Early on in his duties he realized and came to appreciate that the airman's needs were far different than those of ground forces. "It was not unusual for our fliers, whether based in England or in China," he would later recall, "in summer or in winter, to run into Arctic conditions less than an hour after takeoff."[45]

---

[44] Ibid., 227.

[45] Bradford Washburn, "Personal Equipment," *American Alpine Journal*, (1946): 235. For the unique clothing requirements

Until 1941, the U.S. military did not fully appreciate the different needs of its servicemen and, therefore, operated a centralized research and development program. Washburn argued against such a structure, advocating for a separate Army Air Force research and development program. Only then, Washburn believed, would the military fully appreciate and address fundamental differences between the requirements of the Air and Ground Forces which, he stated, was a "simple, yet frequently unappreciated fact that the flier does his fighting sitting still."[46] Hence, the primary concern in developing clothing for the Army Air Force was in the material's ability to insulate a stationary flyer. Yet, the reality of warfare mandated that such clothing be as versatile as possible as the Air Force was equally concerned with protecting the flyer shot down in northern regions or during winter months. Conversely, as Washburn noted, once on the ground, the airmen would need clothing capable of achieving "the proper balance between insulation and ventilation."[47]

---

of the AAF, see also, Bradford Washburn quoted in, Edward O. Purtee, *Development of Army Air Force Clothing and Other Personal Equipment Peculiar to Air Operations* (Wright Field, Ohio: Air Technical Service Command, 1945), 4. (Hereafter cited as ATSC).

[46] Bradford Washburn, "Personal Equipment," *American Alpine Journal*, (1946), 227.

[47] Ibid.

Simon Buckner, of the Alaskan Defense Command, shared Washburn's concerns, stating that a "compromise must be made between extreme of comfort and the extreme of mobility." He further noted that "troops equipped with every comfort will be tied to one spot," while those "outfitted for the maximum mobility are likely to freeze to death."[48] Therefore, in the Spring of 1941, the United States military found itself pressed on multiple fronts to develop, procure and deliver to its troops adequate clothing and equipment. These needs were complex, demanding a balance between adequate protection from extremely low temperatures at high altitudes and substantial versatility for ground-based combat soldiers.

The demands under which military planners and advisors worked was less than conducive to quick and efficient development. During the early days of the war, Army Air Corps crews detested their equipment, citing its lack of insulating qualities, impractical maneuverability in the cockpit due to its large design, and an overall lack of consideration given to the flyers needs. So inadequate was the situation that airmen stationed in Alaska preferred

[48] Simon Buckner to Commanding General, Ninth Corps Area, quoted in Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 11.

civilian clothing and QMC mountain-troop equipment over those items issued to them by the Army Air Force.[49] Indeed, the problem for all branches of service was inherent in the lack of a pre-war research and development effort which resulting in a limited number of clothing and equipment strategies capable of supporting global warfare.

While studying the effectiveness of Army Air Force clothing and equipment, Washburn identified a number of serious problems which he attributed to insufficient direction and ineffective research programs on the part of the QMC. In January 1942, he informed Robert Lovett, the Assistant Secretary of War for Air, that there existed an immediate need for emergency equipment specifically developed for the Air Corps. Subsequently, Lovett dispatched Washburn to Wright Field, Ohio, where most of the Corps' equipment was under development. After a thorough review, Washburn concluded that the basic items available to a downed flyer were "extremely heavy, impractical and a lavish waste of critical materials."[50]

---

[49] C.G. Sweeting, *Combat Flying Clothing* (Washington, D.C.: Smithsonian Institution Press, 1984),2.
[50] Bradford Washburn, "A Report and Recommendations on the Emergency Equipment of the Army Air Corps," March 1942, in Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 136.

Despite Washburn's bold claims, officials at Wright Field defended the equipment, citing the military's need to develop equipment and clothing sufficient to protect both airmen and infantry stationed from the tropics to the Arctic. Washburn argued that the needs required in the two regions were diametrically opposed.[51] He was so alarmed by the lack of adequate AAF equipment that he suggested to Assistant Secretary of War Lovett, the creation of a comprehensive testing program to include food rations, clothing and emergency gear. However, Colonel Chidlaw of the military's Material Division found such a program "only mildly" interesting.[52] This general lack of response to such a critical problem by those in charge at Wright Field was not new. In 1932, Major General Kilner, Office of Assistant Secretary of War, declared that there existed "very extended and bitter criticism" of AAF clothing. However, Brigadier General Pratt defended the Corps' supply of equipment, stating that it was "difficult to obtain a satisfactory solution or uniform consensus of opinion." Indeed, with the outbreak of war ten years later, such a consensus was just as illusive.[53]

---

[51] Bradford Washburn, interview with Mike Sfraga, Denver, Colorado, 5 December 1993. See also, Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 136.
[52] Ibid., 137.
[53] Major General W.G. Kilner to Brigadier General H.C. Pratt, 19 March 1932; Brigadier General H.C. Pratt to Major

Throughout the spring of 1942, lack of coordination and agreement also plagued other branches of the military not associated with the AAF. The military's efforts in developing unique equipment for all theaters of war, including jungle and desert warfare as well as that in mountain and Arctic terrain, needed a more coordinated structure. Therefore, distinct mountain and Arctic units were established within a new "Special Forces Section" of the Army and Robert Bates was selected to direct the QMC's Arctic program. The Army Air Force, frustrated with the quality of its equipment, sought to restructure its efforts in the same regard.

With research and development efforts now on a more solid foundation, the QMC and AAF developed and selected for testing over one hundred items of equipment, clothing and food rations of significance in addressing the needs of both air and ground forces. The manufacturing of these prototypes for field testing was carried out by American private industry which President Roosevelt had declared as the great "arsenal of Democracy." In response, U.S. factories retooled and restructured their work force to accommodate the needs

---

General W.G. Kilner, 7 April 1932, in Edward Purtee, *ATSC*, 1.

of war and began work on a multitude of innovative military contracts.

The industrial retooling of American private enterprise was dramatic with numerous companies taking on rather interesting military contracts. The Mishawaka Rubber and Wollen Manufacturing Company produced felt boot liners that were placed in leather Mukluks developed by the Rasmussen Shoe Co. of Westboro, Massachusetts. The *Experimental Mountain-Ski Boot* was made by the G.H. Bass & Co. through which nails, manufactured by the Asa Osborn Co. of Boston, were driven to enhance traction on snow and ice. The Indiana Hoosier Tarpaulin & Canvas Goods Co. produced the *Horizontal Ridge Tent* while the *Logan Tent* was made by the Atlantic Parachute Company. *Anti Chap Lipstick* was developed for military use by the Chap Stick Company and Ashaway Line & Tine Company of Rhode Island manufactured the *Signal Panel*, *Alpaca Line Overcoat* and *Nylon Mountaineering Rope*. Socks, vests and underwear made from paper products were also developed for testing.[54]

Numerous field tests on clothing and equipment were conducted by the QMC's Mountain and Winter Warfare Board

---

[54] *Report of the U.S. Army Alaskan Test Expedition, 1942, vol. 2* (Washington, D.C.: Office of the Quartermaster Corps., 1942), plates 38, 151, 152, 77, 109, 100.

during the winter of 1942 throughout the continental United States.[55] As these prototypes became available, the QMC believed it to be "imperative that the items be subjected to harsh usage in severe cold to establish their quality and practicability before procurement for the winter 1942-3" could be made.[56] In a meeting with Colonel L.O. Grice of the QMC, Washburn suggested that such an expedition involve several branches of the military so that existing research and development programs could be coordinated. Assistant Secretary Lovett approved the joint field test, marking the first cooperative effort between the two branches in the development of cold weather equipment. He also selected Washburn as the AAF's representative.[57]

---

[55] Robert Bates, interview with Mike Sfraga, Tape recording, Exeter, New Hampshire, 15 July 1992; Albert Jackman, interview with Mike Sfraga, Denver, Colorado, 6 December 1993. Field exercises were conducted in the early winter of 1942 by the Fourth Armored Division at Pine Camp, New York. However, the equipment tested was developed primarily for Armored Divisions and did not include mountain or Arctic gear. Yet, these maneuvers marked the first large scale field testing of winter equipment by the QMC. Equipment developed specifically for ground troops engaged in mountain and Arctic terrain was tested in the late spring of that same year along the slopes of Mt. Rainier in Washington State.

[56] *Report of the U.S. Army Alaskan Test Expedition*, Vol. 1, ii.

[57] Bradford Washburn, interview with Mike Sfraga, Denver, Colorado, 5 December 1993. See also, Bradford Washburn, *Association with the Material Center, Wright Field, Dayton, Ohio, from January 1942 Until March 1943* (Dayton: United

In late spring of 1942, Captain Robert Bates (Arctic Unit of the Special Forces Section) and Washburn began the challenging work of developing the expedition.[58] The most pressing problem in need of solving was the selection of a suitable environment in which a rigorous test of winter equipment could be executed during the summer months. Dr. Terris Moore, Expert Consultant to the QMC recalls the difficult question facing the military:

> Where can we find natural out-of-doors temperatures of at least 20 to 25 below zero Fahrenheit, dependably during the coming summer, on the North American continent... reasonably accessible, where we can work on prototypes... to manufacture late this summer and early fall, for issue to mountain troops and Arctic troops in time for the winter of 1942-43?[59]

Although the military had identified a number of test sites, including Mount Logan in Canada and Mount Rainier in Washington State, Colonel Grice called upon the expertise of

---

States Army Air Corps, 1943). See also, Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 137.

[58] Robert Bates, "Mt. McKinley, 1942," *American Alpine Journal*, (1943): 2.

[59] Terris Moore, Mt. McKinley: *The Pioneer Climbs*, 161.

the American Alpine Club (AAC) to review the situation and recommend a suitable location.[60] After considerable discussion, Mount McKinley, Alaska, was selected as the ideal test site where "heavy snowfall, storms and temperatures to minus 20 degrees Fahrenheit might be found" even during summer months. The mountain's location relative to vital supply lines from Ladd Field in Fairbanks was also considered as it "offered easier accessibility and greater speed in reaching higher test areas than other areas considered."[61]

In early May 1942, official approval for the expedition to be carried out within Mount McKinley National Park was secured through National Park Superintendent Newton B. Drury. Lt. Colonel Frank Marchman was placed in command of the U.S. Army Alaskan Test Expedition. Robert Bates served as second in command and Bradford Washburn was selected to review the performance of the QMC equipment for future consideration by the Air Force and to test specific AAF equipment and clothing.[62] Meanwhile, the Army Air Force

---

[60] Albert Jackman, interview with Mike Sfraga, Denver, Colorado, 6 December 1993. Jackman was a member of the 1942 Mount Rainier Expedition as well as the 1942 U.S. Army Alaskan Test Expedition.
[61] *Report of the U.S. Army Alaskan Test Expedition*, vol. 1, iii.
[62] Ibid., 2; Bradford Washburn, interview with Mike Sfraga, Tape recording, Boston, Massachusetts, 18 June 1992;

began transport of expedition personnel and over six thousand pounds of test equipment from a staging area in Minneapolis, Minnesota to the expedition's eventual headquarters located at Ladd Field, Fairbanks, Alaska.

The seventeen members of the expedition represented several branches of the military including the Quartermaster Corps, Army Air Forces, Army Ground Forces (Mountain Infantry), Medical Corps, Signal Corps, and representatives of the American Alpine Club as well as the Canadian Army and Royal Air Force.[63] Walter Wood, a mountaineer and glaciologist serving as an expert consultant to the QMC, directed the expedition's aerial supply program from Ladd Field to the slopes of Mount McKinley. Although the men would travel via railway to McKinley Park, a significant portion of the test equipment would be dropped from planes to the troops on the mountain.[64]

Bradford Washburn, *United States Army Air Forces: Report on Results of Field Tests and Conferences on Equipment, Alaska, June-July-August, 1942* (Dayton: Untied States Army Air Forces, 1942).

[63] *Report of the U.S. Army Alaskan Test Expedition*, vol. 1, 11. See also, War Department to Lieutenant Colonel Frank G. Marchman, , 22 May 1942, Albert Jackman Papers, 10th Mountain Division Collection, Western History Department, Denver Public Library, Denver.

[64] Walter Wood had significant experience in the employment of aerial supply in mountainous regions. Wood utilized the airplane in support of previous scientific expeditions along the Canadian side of the Wrangell-St. Elias Range in the

Washburn and Wood preceded other members of the expedition to Ladd Field in order of carry out an aerial photographic reconnaissance of the mountain. Although Washburn had conducted the first systematic photographic survey of McKinley in 1936 for the *National Geographic Society*, the two men surveyed the mountain at the end of May to more accurately assess the route on which the expedition would travel.[65] However, plans for additional flights and, indeed, the entire expedition were routinely jeopardized as a result of the Japanese hostilities in the Aleutians. Washburn was alarmed at the absence of defense preparations at the air field, noting that the "glittering roof of Ladd Field's huge hangar has not been camouflaged at all and can be seen clearly from 50 miles away!"[66] He ominously wrote that if

---

Yukon Territory. See, for instance, Walter A. Wood, "The Wood Yukon Expedition of 1935: An Experiment in Photographic Mapping," 1936; Walter A. Wood, "The Parachuting of Expedition Supplies: An Experiment by the Wood Yukon Expedition of 1942," *Geographical Review*, 32, (January 1942): 36-55; Walter Wood, "Report of the Wood Yukon Expedition," Section II, TDS, 5-10, 12,15, 37-43, Albert Jackman File, 10th Mountain Division Collection.

[65] Bradford Washburn, "Over the Roof of the Continent," *National Geographic Magazine*, July 1938, 78-98.

[66] Bradford Washburn, *Mount McKinley Alaska: 1942*, D, 1942, 6, Box 2. Bradford Washburn Collection.

the "Japs are successful in their bid for SW Alaska our job may be nipped in the bud."[67]

Despite Japanese advances in the Aleutians, Wood began air lifting numerous payloads along McKinley's slopes and on 9 June, the first contingent of the expedition departed from Ladd Field by rail, reaching its destination that evening. The men were transported by McKinley Park Superintendent Frank Been to Camp Eielson, where the team began the arduous hike to the base of the mountain. Been noted that the "men had difficulty" as they "were soft" and were "carrying heavy packs" across difficult terrain.[68] Their physical condition soon would change as the men were about to spend the better part of the summer climbing, skiing and traversing the slopes of North America's tallest mountain.

A small base camp was established at the head of the Muldrow Glacier along McKinley's lower slopes. Here, they diligently

---

[67] Ibid., 9. On 3 June 1942 the Japanese Imperial Air Force bombed the small Alaskan community of Dutch Harbor. See for instance *The New York Times*, "Japanese Bomb Dutch Harbor, Alaska, Twice," 4 June 1942, 1. For thorough review of the Aleutian campaign, see Brian Garfield, *The Thousand Mile War: World War II in Alaska and the Aleutians* (New York: Bantam, 1982).
[68] Frank Been, "Superintendent's Narrative: Supplemental Monthly report, January 1941-1943," 10 June, 1942, Superintendent Records, Denali National Park and Preserve Archives, Denali, Alaska.

documented the performance of their equipment which was certainly put through a rigorous test throughout the several-day march to the base of the mountain. Team members recorded detailed notes as to the functionality, durability and overall usefulness of such items as socks, boots, mosquito head nets, frame packs and tents. As time was of the utmost importance, this information was sent via radio to Ladd Field in Fairbanks and subsequently relayed to research installations throughout the country (including Wright Field). Immediate modifications of equipment and, in some instances, the elimination of some items were a result of this rapid communication from the field test expedition.

Conditions on the lower Muldrow Glacier at the outset of the expedition were dismal, with rain and warm temperatures turning the ice into streams of slush and running water. However, such conditions were perfect for a rigorous test of the equipment. "Men let themselves be soaked to the skin to prove the value of water repellent materials," Robert Bates would later recall, while other men "allowed themselves to shiver to learn the minimum temperature" at which the clothing would lose its effectiveness.[69] Although such information attained at low altitude was useful, the military was eager to test the integrity and effectiveness

[69] Robert Bates, "Mount McKinley, 1942," 5.

of the equipment under extreme conditions.[70] Therefore, from early to mid-July, Washburn, Bates, Terris Moore and Einer Nilsson, a civilian consultant to the QMC, established several research camps along the mountain's upper slopes, and a major research and analysis center at the eighteen thousand foot "High Test Area" of the Harper Glacier.

The four mountaineers were soon joined at the high camp by additional expedition members. Field tests of winter gear was conducted in a stark yet effective manner: the men simply depended upon their equipment for survival. Failure of any item to perform under such conditions could prove to be fatal. The "High Test Area" was established so that the equipment could be tested under such conditions for a prolonged period. Moreover, the camp's location on the mountain afforded the AAF a unique opportunity to test high altitude aerial supply capability in support of U.S. mountain troops, as there was a great deal of concern over the effectiveness of these tactics in the European Theater.[71]

---

[70] Bradford Washburn, "Mount McKinley Alaska: 1942," 55.
[71] For a thorough analysis of use of parachutes in troop deployment and supply during both World Wars, see C.G. Sweeting, *Combat Flying Equipment: U.S. Army Aviators' Personal Equipment, 1917-1945* (Washington, D.C.: Smithsonian Institution, 1989), 73-119. Many of the supply loads dropped at the high camp veered drastically off course as result of miscalculating the air speed of the plane and the drag of

However, the team's undivided attention deviated somewhat from their mission because a number of them could not help but consider a summit attempt of the mountain, a much coveted prize even with the ever-present realities of war. As Terris Moore later recalled, this group of men marked the first climbing party on McKinley on which "more than one member had... technical alpine experience...the earliest climbers had no experience at all."[72]

The opportunity was not lost on Washburn, who considered the conquest of McKinley alluring. Yet he was content to spend his "days and nights" on the Harper Glacier, "as it's full with ghosts - Belmore Browne, Hudson Stuck, and Harry Karstens -- every serac, each steep grade, every rock and every plateau brings back stories of the pioneers" who toiled to or just below McKinley's summit. Colonel Marchman, the expedition's military commander, was well aware of the caliber of mountaineers situated below the summit. On 23 July he contacted Washburn via radio from the Muldrow

---

the parachute. Such problems would soon be corrected for future operations throughout the European Theater of war. For a discussion of the problems associated with aerial supply during this expedition, see Bradford Washburn, "Mount McKinley Alaska - 1942," 6.

[72] Ben Read, "An Interview with Bradford Washburn and Terris Moore," *Climbing*, April 1993, 16.

Glacier base camp and declared that they should "try the top as soon as possible."[73]

Needing very little encouragement, Washburn, Bates, Moore and Nilsson set off for the summit just before noon and reached the top of North America at 4:00 p.m., making the third successful ascent of the mountain.[74] Their place in mountaineering history was not lost on the small party and Washburn savored the addition of McKinley to his long list of mountaineering credentials, confessing that his "ambition of many years has been granted."[75] Yet the men did not lose sight of the purpose of their work. Looking out on the green lowlands below from the mountain's summit, Robert Bates contemplated the "whole continent of people beyond" who "were united in the struggle for victory," serving as a reminder that "Alaska itself was under attack and in imminent danger of invasion."[76] The team returned to the high camp later that evening where they spent several more days documenting and photographing the equipment's performance and condition. With this final work now complete the men descended the mountain and rejoined the expedition at the base camp on the Muldrow Glacier. The expedition

---

[73] Robert Bates, "Mount McKinley, 1942", 10.
[74] Terris Moore, *Mount McKinley: The Pioneer Climbs*, 168.
[75] Bradford Washburn, "Mount McKinley Alaska: 1942," 78.
[76] Robert Bates, "Mount McKinley, 1942," 11.

broke camp and began the long walk back to the Park Road. Bates noted that the men were weighed down under heavy loads which included "samples showing strain and wear, or failure of material and design... things that must quickly be corrected in Washington."[77]

"The Mess at Wright"

Washburn criticized the majority of AAF equipment he had tested on the mountain and recommended against further use of most items, including bulky over-garments made of shearling.[78] Immediatly following the expedition Washburn traveled to Ladd Field in Fairbanks where he shared his concerns with military officials. He also interviewed a number of Ladd Field airmen regarding the adequacy of their clothing and equipment. The interviews revealed significant problems with AAF equipment and clothing which supported the findings of Washburn's field test. The men "refused to use the flying clothing given them" he noted, and "nothing seems to be satisfactory."[79] The men were so disillusioned with their equipment that Washburn convinced General Simon Buckner to allow him access to flyers in the Aleutians so he

---

[77] Ibid., 13.
[78] *Report of the U.S. Army Alaskan Test Expedition, 1942*, vol. 4, 107, 118, plate 161.
[79] Bradford Washburn, "Mount McKinley Alaska: 1942," 93.

could get their perceptions of equipment effectiveness. On August 16 Washburn arrived in Umnak, a mere four miles from Japanese forces. Once again Washburn found his McKinley findings supported by AAF personnel as the men were in desperate need of sufficient emergency equipment and had absolute disdain for their cold weather clothing. "The feeling of everyone is that {the use of} fleece-lined flying clothing must be stopped at once," as it restricted movement in close quarters and tended to overheat the men with minimal exertion.[80]

Upon his return to the States, Washburn completed an official report on the McKinley expedition with "some really strong recommendations," as a "big change {is needed} in the personnel working in clothing if we are ever to expect results."[81] Washburn perceived the situation to be so critical that he decided to fill the report with "factual, well proven HELL FIRE!," and "head straight to {the Chief of the Air Corps} General {Hap} Arnold's office with the whole thing" in hopes of finding "fearless officials who can and will really set this thing moving."[82] Washburn assumed

---

[80] Ibid., 95, 107.
[81] Bradford Washburn, *Alaska: August 25, 1942 - March 14,1943*, D, 11, Box 2, Bradford Washburn Collection, Elmer E. Rasmusen Library, Alaska and Polar Regions Archives, University of Alaska Fairbanks, Fairbanks, Alaska.
[82] Ibid., 13.

responsibility to correct the situation as the "men in the field seem to suffer in silence until someone comes along to make an investigation."[83]

Washburn's "Hell Fire" report included a review of problems at Wright Field including the lack of a coordinated research and development program, inadequately trained staff and a preponderance to ignore complaints related to cold weather equipment and clothing by men in the field and experts alike.[84] This critique was based on his nearly decade-long experience in coordinating and outfitting expeditions in remote Arctic environments which was the very reason he had been recruited by the AAF to assist in such efforts. Paul Manson, Civilian Chief of the Clothing Branch at Wright Field, took exception to the report seeing Washburn's condemnation of AAF equipment as a direct and crushing criticism of his leadership. When the two faced off over the subject, Washburn considered it to be a real "row" from which "I came out on top!" Manson was incensed because, as Washburn notes, "he realizes that I am gunning for him, and the report must go out, pronto, before he can double cross

---

[83] Ibid., 14.

[84] Bradford Washburn, interview with Mike Sfraga, 6 December 1993. See also, Edward Purtee, *ATSC*, 5; Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 142.

me."[85] Others However, including Sir Hubert Wilkens, supported Washburn's findings. At a subsequent meeting to review AAF equipment Washburn noted that Sir Hubert Wilkens "did not realize it was Manson's stuff and every so often he'd say 'that's useless' and toss a pair of Manson's pet boots onto to the floor."[86]

Although Washburn's review was supported by a number of cold-weather experts, he believed those individuals in oversight positions in research and development programs at Wright Field had attempted to cover up the situation. "They have stalled my report," Washburn wrote, "and are trying to do things of all sorts so that it will be incorrect when it finally gets through." Indeed, officials at Wright Field appeared to have no intention of releasing a report with such harsh criticisms, declaring the critique to be "interpretative." The "Army boys are clearly trying to cover up what they realize to be a rotten mess," Washburn declared, as he had disrupted their "life of quiet incompetence."[87] Nonetheless, in a subsequent meeting with Wright Field's chief of Material Command, Brigadier General Arthur Vanaman, several commercial airline pilots and

---

[85] Bradford Washburn, "Alaska: August 25, 1942 - March 14, 1943," 15.
[86] Ibid., 20.
[87] Ibid., 26.

various equipment experts found few redeeming qualities in the AAF equipment. One pilot declared that "Wright Field has made no real clothing development progress since World War I." According to Washburn, Manson was "flattened" by such a public declaration.[88]

Shortly afterward Colonel Mills, Acting Head of the Equipment Laboratory at Wright Field, reviewed the report and, according to Washburn, believed it to be accurate. However, he refused to endorse or sign the document as it would be a "straight admission of incompetence." As Washburn later recalled, Mills attempted to end the conversation, stating that "I could not appreciate the Army viewpoint," and declaring that "we must stick together." Washburn was infuriated with Mills' statement, likening such actions to that of "skunks" who "try to keep close to each other for protection."[89] Yet, he felt a "certain feeling of pride and triumph" with Mills' admission of "incompetence" which "completely vindicated" his report.[90]

However, Washburn realized that such "vindication" did little to secure adequate AAF equipment. Indeed, the situation was far more critical than he had first believed

---

88 Ibid., 30.
89 Ibid., 32.
90 Ibid.

because the equipment problems now had been dismissed for obvious self-serving reasons by particular high-ranking Air Force officials. Of the Army Air Force's preparedness to outfit flyers for the winter of 1942-43, Washburn noted that "there is no clothing and no emergency gear... and a real crisis exists." "While we have stalled," he wrote, the Quartermaster Corps had transformed their Mount McKinley expedition research recommendations into "new and better items" which the AAF was now forced to adopt in order "to cloth the Air Corps this winter."[91]

Frustrated with the lack of progress at Wright Field, Washburn resigned his civilian post and briefed General Arnold on the situation. Cognizant that his report now had become a sensitive military document, Washburn smuggled a copy of it past Wright Field guards in a rolled-up daily newspaper. A copy was given to Arnold when the two met.[92] Washburn shared with Arnold his belief that the AAF was in dire need of a separate, expanded and well-staffed AAF clothing program at Wright Field which would compare well

---

[91] Ibid., 33.

[92] Bradford Washburn, phone conversation with Mike Sfraga, 10 January 1997. Because of the sensitivity of the situation, Washburn did not document this event. This information was attained from direct questioning regarding the way in which Washburn was able to deliver the document to Arnold at a time when he was under particular scrutiny.

with that of the QMC's Ground Forces program. Although Arnold dismissed Manson from his position and implemented a number of additional changes, problems in both equipment development and personnel plagued subsequent clothing advances. According to Washburn, Arnold's efforts did little to enhance the AAF research and development program at Wright Field.[93] Throughout the winter and spring of 1943, Washburn conducted a number of cold weather equipment investigations along the newly constructed Alaska-Canadian Highway for the Alaskan Defense Command. During this time, reports of severe frostbite to the hands and feet of U.S. airmen in combat over Europe made their way to the States, lending credence to Washburn's continued condemnation of Wright Field's leadership and direction.

---

[93] *Bradford Washburn, Alaska: August 25, 1942 - March 14, 1943*, 39. Washburn was appointed Special Liaison between the Quartermaster General and the Commanding General, Alaska Defense Command, Simon Buckner. Subsequent meetings held at Wright Field regarding the use of several types of clothing and materials were convened. As Pitkin points out, Washburn's assertion that significant problems existed with AAF cold weather clothing was supported by military officials who stated that such items were "not entirely adequate over a wide range of environmental conditions." Thomas Pitkin, *Quartermaster Equipment for Special Forces*, 143. Washburn believed that a separate research and development program, staffed by qualified experts with direct input from the combat troops would be the only practical solution in solving the AAF's clothing and equipment problems, Bradford Washburn, interview with Mike Sfraga, 6 December 1993, Denver, Colorado.

THE SMOKING GUN

The reports of frostbite among airmen in the European theater were painfully accurate. In February of 1943, Lieutenant Colonel Loyal Davis, Senior Military Consultant in Neurological Surgery, identified fourteen cases of severe frostbite among members of the 8th Bomber Command (European Theater of Operation) over the course of a ten day medical visit. In a stinging condemnation of AAF clothing and equipment, Davis attributed the direct cause of hand and foot frostbite to the failure of equipment, in particular the "tightly fitting gloves and boots" responsible for "constricting fingers and toes." He reported numerous instances in which "men have not worn adequate clothing so that the entire body becomes chilled," and identified a general lack of proper training in the use of their equipment. Davis also found problems with the "structural features" of the bombers, making it possible for "cold air" to flow through the frame and machine gun turrets "strike{ing} the gunners at high velocity."[94] Davis

---

[94] Loyal Davis to Brigadier General Paul Hawley, Chief Surgeon, E.T.O.U.S.A., 18 February 1943, Loyal Davis Personal Papers, hereafter cited as LDPP. Dr. Davis placed a great deal of personal correspondence regarding this issue with Bradford Washburn. Dr. Washburn has graciously allowed me access to these files, all of which will transferred to

suggested, as did Washburn, that clothing and equipment recommendations be obtained from men in combat who could "prescribe... proper flight equipment." Davis suggested that electric suits worn by AAF crew members be wired in such a way as to avoid a break in the electrical circuit, which occurred whenever a glove was removed, resulting in the entire system shutting off. [95]

Continued investigation by Davis of the Eighth Air Force in the spring and summer of 1943 revealed an additional 93 cases of frostbite involving 86 patients. He took detailed

---

the Bradford Washburn Collection at the University of Alaska Fairbanks Archives subsequent to this writing. Davis was the first to identify High Altitude Frostbite, see for instance, Loyal Davis *et al*, "High Altitude Frostbite: Preliminary Report," *Surgery, Gynecology and Obstetrics*, 77 (December 1943): 561-575. Davis was also interested in the identification of pathological processes of frostbite and the development of successful treatments for such injury. Although frostbite was well documented at the time, the exact physiology was still to be identified.

[95] Ibid. The Aero Medical Laboratory (AML) at Wright Field studied the effects and causes of cold on the human body. For a review of the AML's history and mission, see C.G. Sweeting, *Combat Flying Equipment*, 3-20. In June of 1942 the National Research Council began a review of research programs pertaining to Human physiology and the development of effective military clothing for various theaters of war. A subcommittee, composed of members of the Harvard fatigue Laboratory, the Medical Research Laboratory at Fort Knox, Office of the Air Surgeon, the Surgeon General of the Army, and others, studied these issues. See, for instance, Louis Newburgh, *Physiology of Heat Regulation and the Science of Clothing* (Philadelphia: W.B. Saunders, 1949).

photographs of the airmen's blackened and gangrened fingers, amputated digits and blistered toes. These photographs would not only serve as supplemental information for Davis's medical report, but they would provide for Washburn tangible and subsequently damning evidence of the AAF's inefficient clothing programs.[96] Davis presented his findings to General Grow, Chief Surgeon, Eighth Air Force, who dismissed Davis' broad equipment concerns. Subsequent attempts by Davis to discuss his findings were repeatedly ignored by Grow's staff. "It was obvious that Grow had indoctrinated his medical officers," Davis would later write.[97]

Davis soon became frustrated with AAF officials who he believed were forsaking the health and welfare of U.S. airmen. His claims, as well as those made almost simultaneously by Washburn, were supported by additional injury statistics. From the onset of air operations in Europe through the end of 1943, over half of AAF reported injuries were due to high altitude cold and frostbite. Sixty four percent of these injuries occurred in waist, tail and ball turret gunners who were exposed to winds in excess of 200 miles per hour in which they removed their bulky and

---

[96] Lt. Col. Loyal Davis to Chief Surgeon, Brigadier General Paul Hawley, ETO, 31 August, 1943, LDPP.
[97] Loyal Edward Davis, *From One Surgeon's Notebook* (CITY: C.C. Thomas, 1967), 121-122, LDPP.

tight fitting gloves to fire machine guns or reload ammunition. At least half of all of these injuries were attributed to inadequate equipment, failure of equipment to perform or the removal of equipment during combat.[98] Reiterating Davis's assertion that Air Force personnel required training in the use of their equipment, Dr. Michael DeBakey later wrote that American airmen had "not been adequately trained in the prevention of cold injury," and therefore, "most did not know how to protect themselves against the dangers of cold."[99]

In August of 1943 Davis discussed with General Arnold the troubling incidents of high altitude frostbite he had discovered. Arnold ordered Davis to report his findings to Major General Norman Kirk, the Surgeon General of the United States, to whom he outlined, later that month, the number, severity and causes of the injuries reported to date along with photographic documentation. Grow, also present at the briefing, "objected strenuously to any implications" that the AAF was not adequately addressing the airmen's needs. Davis fired back, claiming that "he {Grow} had placed every kind of obstruction in the way" of correcting the

---

[98] Colonel Tom F. Whayne and Dr. Michael DeBakey, *Cold Injury, Ground Type* (Washington, D.C.: U.S. Government Printing Office, 1958), 130-132.
[99] Ibid., 132.

situation.[100] Davis continued his condemnation, accusing Grow of misstatements and a deliberate cover-up of the facts. Although Davis felt somewhat vindicated by the positive response he received from Arnold, which translated into some progress of research and development (both in terms of research conducted on human physiological response to cold as well as clothing/equipment development), he still believed that the AAF harbored a number of individuals and processes which needed either elimination or drastic restructuring.[101]

Unknown to Davis, Washburn and Henry Field, another AAF Civilian Consultant, decided to covertly take issues related to the poor performance of AAF clothing production into their own hands. They aimed right for the political top and prepared an unsigned "Report on A.A.F. Materiel Center, Wright Field" for President Roosevelt, in which problems related to Wright Field were outlined.[102] "It is reported" the document begins, "that the direction and initiative... of emergency and flying equipment are inadequate" and (See Figure 3.1) "clever 'whitewashing'" of the facts and

---

[100] Loyal Davis, *From One Surgeon's Notebook*, 142-143.
[101] Ibid., 143.
[102] Bradford Washburn, interview with Mike Sfraga, 6 December 1993, Denver, Colorado. Bradford Washburn, *Alaska: March 15, 1943 - November 14*, 1945, D, 39, Box 2, Bradford Washburn Collection.

replacement of personnel had "little real benefit," in correcting the situation. Washburn and Field cited a lack of attention to the "importance of a high standard of safety...lack of competent and experienced personnel for research," and the desperate need for enhanced communication with "our Air Forces in the theaters of war." The report recommended a complete investigation of personnel within Wright Field's Material Command and, if such allegations were to be verified, "incompetent or obstructionist personnel should be transferred or removed."[103] The report was placed on President Roosevelt's desk on 30 August 1943,

---

[103] {Anonymous} Bradford Washburn and Henry Field, "Report on A.A.F. Material Center, Wright Field," TD, 30 August 1943, Army Air Force File OF 25-U, Franklin D. Roosevelt Collection, Franklin D. Roosevelt Library, Hyde Park, New York. Miss Grace Tully, President Roosevelt's personal secretary and an acquaintance of Henry Field, placed the report on the President's desk, never identifying the source. Neither Washburn nor Field retained a copy of the memorandum for fear that the document could be traced to its source. Additionally, only cursory references to the memorandum is made by Washburn in his wartime diary. In fact, such references occur after the document had been delivered to the President, and even then such a reference is cryptic to the casual eye. See, Henry Field to Bradford Washburn, 20 April 1981, 93. This and subsequent correspondence between Washburn, Field and Davis has been given to Mike Sfraga by Bradford Washburn for use in this study. This material will be added to the Bradford Washburn Collection of the University of Alaska Fairbanks subsequent to this writing. Hereafter, such correspondence will cited as BWPP. See also Bradford Washburn, *Alaska* March 15-November 14, 1943.

the very same day Davis revealed his "evidence" to Surgeon General Kirk.[104] On 1 September Washburn was summoned to the Office of the Air Inspector General, Captain Beeghly, to discuss the situation at Wright Field. The Washburn-Field memo to the President had begun to effect change. Washburn reiterated to Beeghly, who could not have known that Washburn was behind the uproar, his long-held belief that emergency and cold weather equipment for AAF personnel was desperately inadequate. Reform now began in earnest. On 10 September, the AAF created the Emergency Rescue Branch under the command of Lieutenant Colonel C.B. Whitehead. "Half the battle for a cleanup of Wright Field has been won," Washburn proclaimed.[105]

General Arnold returned to the States in early September from a fact finding mission to several AAF operations abroad where, according to Washburn, "he saw a lot of men who had their hands frozen on account of rotten gloves in England." As Washburn later recalled, General Arnold convened meeting with a number of Wright Field staff member and "gave them hell." As a result of the meeting, Major General Grow

---

[104] Dr. Loyal Davis to Bradford Washburn, 28 April 1981, LDPP.

[105] Bradford Washburn to Loyal Davis, 31 March, 1981, BWPP; Bradford Washburn, "Alaska: March 15, 1943 - Movember 14, 1945," 96.

requested a complete QMC winter suit, developed by Washburn and others for ground troops, so that AAF personnel could test its effectiveness for consideration throughout England.[106]

Even though Grow considered the QMC equipment for use, the AAF was not interested in acquiring or developing many new items since they still had a significant supply of their own equipment prepared for distribution. General Buckner, of the Alaska Defense Command, attempted to requisition some of the QMC clothing for Alaskan flyers but his request was denied. "Buckner was furious," noted Washburn, "that {they} are not going to let his men get our new stuff till the old junk is used up!"[107]

To Washburn, the futility in trying to make sense of the situation was continually frustrating. Absolute reorganization at Wright Field seemed improbable. "It's depressing to the limit," he admitted, "but what in the hell can we do about it...they've got such high political pressure."[108] Whatever power the authorities at Wright Field enjoyed was soon eclipsed by a fortuitous meeting between Loyal Davis and Henry Field, in which Davis shared his

---

106 Ibid., 100-101.
107 Ibid., 103.
108 Ibid., 105.

"frostbite" photos. Field invited Washburn to his Georgetown home to visit with Davis. Here, Davis gave Washburn the photos which he declared "the grizzliest pictures of frostbitten hands I've ever seen."[109] Washburn shrewdly delivered the pictures to Robert Lovett, Assistant Secretary of War for Air, because the entire problem was a "result of...filthy incompetence at Wright Field."[110] According to Washburn, Lovett "was really bothered and shocked" by the photographs.[111] On 28 September Lovett received from the White House a copy of Washburn's anonymous report; a note from the President indicated that the criticisms were in "no way...connected with the Air Corps."[112] Indeed, Washburn was now associated with the QMC, and therefore protected from direct implication. His gamble had begun to pay dividends and the turning point in the entire affair was soon to come about.

---

[109] Ibid.; Bradford Washburn to Loyal Davis, 31 March, 1981. Washburn's interest in the subject of cold injury and frostbite continued well after the war. See, for instance, Bradford Washburn, "Frostbite: What It Is - How to Prevent It - Emergency Treatment," *New England Journal of Medicine* 266 (10 May 1962):974-989.
[110] Ibid.
[111] Bradford Washburn, "Alaska: August 15, 1943 - November 14, 1945," 106.
[112] Franklin D. Roosevelt to Henry Hopkins, 28 September 1943. Army Air Force File OF 25-U, Franklin D. Roosevelt Collection.

A HOUSE OF CARDS

Lovett immediatly began a personal investigation into the report's allegations and soon delivered a two page review critical of AAF Equipment Lab to the White House. This memorandum was a blistering condemnation of Wright Field in which he called the criticisms "correct in my opinion." Lovett revealed that such problems were discovered months earlier by AAF Flight Surgeon General Grow whose "investigation {on the inadequate AAF clothing} was completed last month."[113] Indeed, Grow had been informed of the problems among the 8th Bomber Group by Davis, yet choose to ignore the seriousness of the situation. It was only after Surgeon General Kirk placed stock in Davis' report that Grow was forced to acknowledge the problem. However, Grow dared not challenge Lovett on the subject and no doubt convinced Lovett that he had taken proactive measures to correct the problem.

Lovett indicated that personnel "responsible for the rather unsatisfactory performance of this section to date have been removed" and a total reorganization of the Flying Clothing Section was underway.[114] The restructure included the

---

[113] Robert Lovett to Henry Hopkins, 1 October 1943. Army Air Force File OF 25-U, Franklin D. Roosevelt Collection.
[114] Ibid.

separation of the Flying Section from the Equipment Laboratory and the appointment of Lieutenant Colonel A. Pharo Gagge as Head of the now autonomous section.[115] Lovett requested the "services of Bradford Washburn to head up the Clothing Section from the point of view of experimentation, testing, etc."[116]

Washburn had been vindicated and reveled in the "triumphant end of a battle... starting since I left the Aleutians."[117] His return to Wright Field would be a rather interesting turn of events. "God knows what awaits me," Washburn wrote, "It's a far cry from 13 months ago when I left - now I'm going back as a Special Assistant to the Commanding General {Major General Charles Branshaw, Material Command}."[118]

Washburn's effectiveness at Wright Field would have been tenuous at best if he had not been given the latitude and

---

[115] C.G. Sweeting, *Combat Flying Equipment: U.S. Army Aviators' Personal Equipment, 1917-1945* (Washington, D.C., 1989), 10. Subsequent to General Arnold's visit to Europe, when he discovered the degree to which American flyers were suffering from frostbite, he placed all the AAF clothing research and development under the personal supervision of Major General Charles Branshaw, Commanding General, Material Command. Branshaw then selected Gagge to direct the new AAF Clothing Section.

[116] Ibid.

[117] Bradford Washburn, "Alaska: March 15, 1943 - November 14, 1945," 121.

[118] Ibid., 136.

authority to make the necessary changes. He felt strongly that an infusion of new staff was needed at the Material Command in whom he would entrust the new operation of research and development. Washburn argued for "new able experienced men" who were "fearless" and who he could "trust." General Branshaw agreed and drafted a recruitment letter for such personnel in which he stated:

> There is no other place in the Army where such huge quantities of costly and intricately important material are entrusted to the care of so few young men. In addition to this, there is no other position of responsibility held by any group of men where failure of only one part of the clothing of a single individual can cause so much disastrous results.[119]

Washburn experienced many hurdles in revitalizing the Wright Field clothing program. The inherent problems in designing protective clothing for AAF flyers were many, demanding the consideration of numerous patterns, degree of comfort, style and articulation of garments in both the sitting and

---

[119] Ibid., 125.

standing position. These problems had long been realized by those working on the issue. However, in the winter of 1943-1944, demands on design and functionality were magnified by a considerable increase in the number of high altitude bombing missions undertaken over Europe.[120] Incidents of cold injuries increased dramatically from 1942 through the winter of 1944 as a result of expanded aerial bombardment that required men to spend longer periods of time in the air and fly more missions.[121]

Although efforts were now underway to correct AAF equipment problems, the lag time in adopting new designs and the subsequent production and procurement of such items was substantial. Change at Wright Field first occurred with the restructure of a number of clothing units and procedures. There existed a complicated organization of departments whoich were responsible for development, testing or production that interfered with procurement and distribution of the equipment. Historian Edward Purtee points out the structure at Wright Field mandated the requisition and eventual procurement of clothing "so far ahead of the time

---

[120] Edward Purtee, *ATSC*, 7,9.
[121] Tom F. Whayne and Michael DeBakey, *Cold Injury, Ground Type*, 132.

when the equipment would be available that the equipment was frequently outmoded before it arrived."[122]

"UNCONVENTIONAL METHODS"

The new Clothing Branch initiated many design changes but the process was delayed by the substantial number of "old" items of clothing already in production. Washburn's predecessors had invested considerable financial and human resources in the development of equipment and clothing subsequently deemed inadequate.[123] Yet, the military was stuck with thousands of items it was legally bound to purchase from private manufacturers which were subsequently delivered to numerous theaters of combat. While investigating AAF clothing in Europe during the winter of 1943-1944, Colonel A.P. Gagge noted that the "number of bombers available for combat was determined by the amount of adequate clothing available more than by any other factor."[124]

---

[122] Edward Purtee, *ATSC,* 15.
[123] The AAF initiated an investigation into a more efficient flying suit made from Alpaca which had received good ratings from combat flyers. However, there existed a considerable stockpile of bulky Shearling suits which the military issued despite its proven inadequacy. See, for instance, Edward Purtee, *ATSC,* 16.
[124] Ibid., 16.

Washburn condemned the old organization at Wright Field for such inadequacies and boldly stated his opinion that there previously had existed peculiar deviations from standard contract negotiations in the granting of AAF clothing contracts to private vendors. He suspected high-ranking officials in at Wright Field of benefiting financially from "kick-backs" offered by "friendly businessmen."[125] He contended that clothing design specifications "were drawn up so that no one but their friends could make them."[126]

Washburn's repeated condemnation of certain AAF personnel during his first assignment at Wright Field made him a target of an apparent sting operation. For example, while at Wright Field, a salesman offered an expensive doll as a "gift" for Washburn's newly born daughter. He accepted the doll but, since he was convinced it was a set-up by the salesman and military officials, promptly deposited the present into a safe with a note indicating the nature of the gift, stating that the package would be opened after the war ended. These actions, he believed, would eliminate further

---

[125] Washburn was told by an unnamed source in October of 1943 that officials at Wright Field were using their own tailors for the production of AAF clothing rather than "qualified tailors already identified" by the Air Force. Bradford Washburn, "*Alaska: March 15, 1943 - November 14, 1945,*" 120.
[126] Bradford Washburn, interview with Mike Sfraga, 10 January, 1997.

threat of blackmail in attempt to secure his silence.[127] The relationship between Washburn and Wright Field officials was so strained that he believed "they were doing everything they could to trip me up and I'm sure that they ransacked my room occasionally."[128]

"Unconventional methods," was how Washburn explained the "placing of contracts" by officials at Wright Field. Inadequate processes like these were first attacked and rectified as a result of Washburn's "banned" 1942 report and subsequent covert memorandum to Roosevelt in 1943. By early 1944, the vast majority of organizational and procedural problems had been corrected and strict policies were enacted for the preparation, design, control, standardization, contract award and production of all new AAF clothing.[129]

Once organizational hurdles were surmounted, significant progress was made in research, development and eventual field testing of new AAF equipment. However, political and economic realities continued to plague Wright Field's ability to totally re-supply AAF flyers with the equipment

---

[127] Bradford Washburn, interview with Mike Sfraga, 6 December 1993, Denver, Colorado.
[128] Bradford Washburn to Henry Field, 17 April, 1981, BWPP.
[129] Bradford Washburn, interview with Edward Purtee, in *ATSC*, 17.

Washburn and others deemed necessary. Some of these problems were not easily corrected as they were representative of the very way in which the Federal Government carried out wartime business.

Purtee points out that a critical winter flight suit, capable of protecting an airman at high altitude, was indeed the most controversial item of equipment among developers and flyers. Between 1935 and 1940, there was "general dissatisfaction with the shearling suits... but no extensive effort was made to develop any other type of suit for replacement."[130] Although the military was approached as early as 1940 by private industry to supply lighter and less bulky pile woven garments to replace shearling, the AAF found "the present Air Corps sheep shearling flying clothing" to be the "best available for the purpose," and "no change in the present winter flying clothing" was contemplated.[131] The AAF continued their support for shearling up to the outbreak of World War II despite the fact that cold chamber tests revealed that the amount of shearling needed to keep a flyer warm in temperature between minus 30 and minus 50 would considerably hinder the

---

[130] Ibid., 34.
[131] Chief, Experimental Engineering Section to Continental Mills, inc, 24 June 1940, in, Edward Purtee, *ATSC,* 35.

performance of an airman and "contribute toward dangerous fatigue."[132]

The increase in aerial bombardment in Europe throughout 1942-1943 resulted in an increased demand for shearling, despite the negative results which Washburn and AAF flyers had given to the product. Nonetheless, sheep farmers were encouraged to increase their supply of shearling to meet war time demands.[133] Flyers were ordered to adopt a "layering system," utilizing several types of clothing to make up for the shortage of shearling garments. This system afforded the flyer the ability to regulated body temperature and provide ease of movement within the cockpit and it quickly became popular with many airmen.[134] Moreover, the War Production Board, which had oversight powers on issues related to equipment, recommended the implementation of other fabric garments that had proven to be adequate in protecting the flyers. One such item was the "Type E" Royal Canadian Air Force suit which Washburn had given high marks after testing it on Mount McKinley in 1942. This suit was found to be an improvement over shearling when used in a layered system.

---

[132] Memorandum EXP-M-54-653-18, 3 July 1940, in Ibid., 36.
[133] Purtee notes that production of shearling increased from three million pelts to over 9 million pelts as a result of military orders to private sheep farmers. See, Edward Purtee, Ibid.
[134] Ibid., 37-38.

Despite such positive response to a layered and less bulky system, some military officials were concerned that a drastic reduction or elimination in shearling purchases from the private sector -- due to the adoption of alternative clothing items and layering schemes -- "would seriously upset the trade and cause great financial losses" to those "who responded patriotically to the promotional activities of the government."[135] However, Washburn's report outlining the shortcomings of shearling and negative reports from flyers in the European Theater did bring about investigation into alternative clothing.[136] Yet research and development of such items appears to be limited to 1942, since, as we have seen, the AAF was not too interested in creating competition for shearling garments.

---

[135] Frank L. Walton, Deputy Chief, Textile, Clothing and Leather Branch, War Production Board to Colonel W.F. Volandt, AAF, 2 November 1942, in Edward Purtee, *ATSC*, 39

[136] Field tests of shearling and other AAF clothing were carried out in Alaska, Ladd Field, under the command of Colonel Gaffney during the winter of 1942-43. Gaffney found that although shearling provided adequate protection in extreme winter conditions, it should be replaced for AAF personnel with a less bulky garment. See, for instance, *Report of Cold Weather Test Detachment: Winter of 1942-1943, Laboratory Reports*, vol. 2 (Dayton and Fairbanks: United States Army Air Corps, ND), 111-113. The reports recommended strongly the use of Alpaca with wind-proof overgarments for wind protection and added warmth and flexibility, 114-115.

Although Washburn's work at Wright Field resulted in significant progress in reshaping the development and testing of new equipment, and despite the negative response to items produced from shearling and the AAF's knowledge of the inadequacies of such clothing, political and economic factors mandated U.S. flyers to continue to wear such clothing. The considerable build-up of shearling stores delayed the procurement and distribution of new clothing materials and designs until such time as all stores of shearling items were exhausted.

Once the "moral obligation of the federal government" had been met, no additional orders for or requirements of shearling clothing were made after the fiscal year 1944.[137] The AAF, as early as 1942-1943, had developed prototype Alpaca clothing, but production to any significant degree was, of course, curtailed due to the emphasis placed on shearling. In the fall of 1943, the development and production of new clothing was made a top priority for the winter of 1944 and included the enhancement of the electrical suit as well as Alpaca clothing.[138]

---

[137] Edward Purtee, *ATSC*, 41.

[138] Major General W.H. Frank to Commanding General, AAF, 4 August 1943, in Ibid., 42.

Electric suits were effective but problems with the circuitry were ever present. The design of such suits began at Wright Field in 1918 but few developments were made during the inter-war years. Throughout the early part of World War II, incremental advances were made with the suits but there still existed the problem of heat regulation. By 1944 improvements in wiring and the implementation of Alpaca and cotton twill undergarments significantly enhanced the electrical suit to protect the flyer in temperatures as low as minus 60 degrees Fahrenheit. In the waning days of World War II, Washburn noted that the "ideal electric suit (toward which we are rapidly progressing) will be one in which... heat is automatically controlled by thermostats."[139] Such suits were under development at the time but were not introduced into combat as regulatory thermostats were still not reliable.[140]

Although the electric suit performed adequately, field tests on wool pile fabrics and Alpaca were very promising as early as the winter of 1943. General Gaffney and Washburn recommended several changes to the Alpaca suits being tested

---

[139] Bradford Washburn, interview with Edward Purtee, 17 February 1945, in, Ibid, 54.
[140] Lieutenant Stewart Seass, interview with Edward Purtee, 19 February 1945, in , Ibid., 55.

in cold chambers and at Ladd Field.[141] Clothing made from Alpaca wool was standardized in the late winter of 1943 and available to combat flyers in the early months of 1944.

The addition of these garments, when used in conjunction with or in the place of electric suits, afforded AAF personnel freedom of movement with adequate protection from cold temperature. Additionally, inserts made of rayon were developed and employed for use under larger mitten type gloves. This allowed pilots, gunners and navigators the dexterity needed to carry out their tasks, yet provided some protection from chilled metal parts and high altitude frostbite. The inserts also were used in conjunction with the electrically heated F-2 and F-3 gloves. Advances in footwear for stationary flyers combined an insert (still made from shearling) with a larger A-6 overboot. An electric shoe sock was also developed and employed, in modified design, throughout the rest of the war.

---

[141] Edward Purtee, *ATSC*, 60, 59; *Report of Cold Weather Test Detachment: Winter of 1942-1943*, vol. 2, 114-115.

THE DIVIDENDS EMERGE

Statistics bear out the effectiveness of Wright Field's ability to design, develop and deliver significantly better clothing and equipment subsequent to Washburn's return in the fall of 1943. For instance, injuries sustained from high altitude frostbite among members of the Eighth Air Force in Europe reached highs of 1,489, in 1943 (July-December) and over 1,700 in 1944. However, the number of injuries dramatically decreased to only 151 in 1945 due to better equipment, enhanced organization, standardization, input from combat veterans, procurement standards and implementation of recommendations from field test expeditions.[142]

To be sure, all the advances in clothing and equipment can not be credited to Washburn. Many thousands of individuals, both civilian and military, were honest and hard-working in their efforts to supply U.S. troops with the finest clothing and fighting equipment possible. There never existed a lack of good design ideas, nor was there a void in the knowledge concerning cold weather clothing schemes. Granted, production and material limitations were considerable and

---

[142] Tom Whayne and Michael Debakey, *Cold Injury, Ground Type*, 132.

the complex needs of the AAF airmen were varied and difficult to address fully. When one considers the environmental changes a pilot and crew experienced on each mission (temperature, altitude, air pressure and motion), it is no wonder clothing and equipment development was not easily and quickly devised.[143] However, this very point was at the core of Washburn's frustrations and contempt for certain Wright Field officials. He believed the task before the U.S. was so grand and so intricate, that human ego and financial gain served as a most unnecessary and particularly devastating pitfall.

Washburn's consistent and ceaseless abhorrence of AAF clothing and his repeated accusations of improper conduct of AAF personnel finally triggered complete reorganization of winter and high altitude clothing operations at Wright Field. Therefore, one may draw from these actions that had Washburn (as well as Field and Davis) not exerted their beliefs in regard to inadequate AAF clothing, many more serious injuries would have materialized. Reflecting many years later on these events, Washburn shared with Davis his belief that his "tough memorandum to FDR" and Davis'

[143] George Gray, *Science at War*(Freeport: Books for Libraries Press, 1972), 224-226, 239-243.

"pictures changed the course of the whole 'Personal Equipment' program" at Wright Field."[144]

In addition to the considerable strides in cold weather clothing production which were made by the winter of 1944, new items of emergency clothing and equipment were also developed and ready for actual field testing. Such tests were carried out under the auspices of Washburn in a number of field excursions during the winter of 1944-1945. In October of 1944, Washburn organized a four-man winter expedition to the Mount McKinley region with the objective to test "under miserable winter conditions" currently employed emergency equipment and several new items "which were under consideration for replacing other material in the standard emergency gear."[145]

Washburn and Captain Robert Sharp (a glaciologist by profession), of the United States Air Force Arctic-Desert-Tropic Information Center, had extensive cold weather experience while the other two men were novices and thus, "were the 'ideal passengers in a USAF airplane'" to test the

---

[144] Bradford Washburn to Loyal Davis, 31 March 1981, BWPP.
[145] Bradford Washburn, "Alaskan Field Test - U.S. Air Force Emergency Equipment and Food: October 17-December 9, 1944," D, i, Bradford Washburn Collection.

effectiveness of such equipment.[146] Plans for the expedition called for a sixty mile hike from Denali National Park through the heart of Alaska's wilderness to Colorado Station on the Alaska Railroad [see figure 3.3]. However, these plans were abruptly changed as Washburn was detached to the site of a C-47 aircraft which had crashed into Mount Deception (11,826 feet), in the vicinity of Mount McKinley, two months previously. Washburn had photographed the region and Mount McKinley in 1936 for the *National Geographic Society,* had climbed McKinley just two years before and was intimately familiar with this region. He left his small party in the command of Sharp and served as guide to a military rescue team, leading them up the Brooks Glacier and eventually to the wreckage site. An excavation of the aircraft failed to uncover any remains of the nineteen men who had been killed.[147] Subsequent to the rescue operation, Washburn led a small partly of men to the mountain's summit, making the first ascent of the peak. Soon after he rejoined the AAF test expedition for the remaining portion of the hike and reached Colorado Station, Alaska along the Alaska Railroad in early December.[148]

---

[146] Ibid.
[147] Ibid., 13-29.
[148] Bradford Washburn, "First Ascent of Mount Deception," *Sierra Club Bulletin* 36, no. 5 (1951):94-105.

Washburn's final field expedition, with the charge to test emergency and survival equipment, came in the waning months of the war and was carried out from March through May of 1945. The test site once again encompassed an area adjacent to Mount McKinley - from the McKinley River to the Brooks Glacier and onto the slopes of Mt. Silverthrone (13,800 feet), eleven miles northeast of McKinley. Team members rated the majority of clothing and equipment (including shoe-pac boots, sleeping bags, gloves, goggles and tents) "Good" to "Superior" with some modifications recommended for nearly each item.[149] These findings constituted significant progress in the development and production of such materials and marked the enhanced level of protection AAF flyers were now afforded.

Writing in 1946, Washburn summarized his thoughts about his efforts at Wright Field, and about all of those individuals who had worked so diligently on AAF clothing problems:

> Although there is scarcely a man in any branch of our services who does not feel that some of his equipment was far from perfect, you will not find one in ten thousand who would prefer to renounce

[149] *Alaskan Field Test of AAF Emergency and Survival Equipment: March to May 1945* (Dayton: Air Technical Service Command, 1945), 21-138.

> all of his American food and equipment in exchange for that issued by any other of the warring powers. The United States equipped its fighting men better than any other country in the world.[150]

NEW HORIZONS

In a letter to his parents immediately following the war, Washburn lamented that his work at Wright Field was "an awful struggle for 18 months." Yet he also boasted of his "smashing victory over the old guard." Washburn savored the "victory" and remained steadfast in his conviction that "it is worth fighting for ideals even if they seem absurdly high to most people." Washburn, like the majority of citizens emerging from the dark cloud of war, confessed to his parents, "I feel as if a chapter in my life had finished and a new one was about to begin."[151]

---

150 Bradford Washburn, "Personal Equipment," 243.

151 Bradford Washburn to Mr. and Mrs. Henry Washburn, 1 September 1945, BWPP. Indeed, great strides had been made by 1945 in equipment for AAF flyers and, for that matter ground troops as well. Although research continued after the war on such issues, with the outbreak of the Korean War the United States once again faced cold weather clothing problems. For instance, during the winter of 1950, over four thousand patients experienced significant cold injury and were transported to a special Cold Injury Section at Osaka Hospital. See, for instance, K.D. Orr and D.C. Fainer, *Cold Injuries in Korea During Winter 1950-51* (Fort Knox: Army Medical Research Laboratory, 1951), 2.

Curiously enough, Washburn's life had already begun to change prior to the war's end. It was the Silverthrone expedition that supplied the necessary opportunity for this change to occur. While camped on Mount Silverthrone, Washburn instructed engineers at Ladd Field in Fairbanks to deliver field survey equipment to him in hopes of "lessen{ing} the inevitable boredom" of the field test. He noted that each of his three military expeditions to the McKinley region were seriously "handicapped from start to finish by {the} lack of a good map."[152] Therefore, he began a preliminary survey of Mount McKinley and the surrounding region, the first such work to employ modern instrumentation. As a result of this work Washburn determined the position and height of McKinley's taller south peak (20,320 feet) and established a more accurate height for the mountain's north peak - just 853 feet shorter than its companion. This information represented the first accurate survey control data ever obtained of the mountain. Washburn's brief, yet fruitful, survey work was soon followed by an Air Force aerial photographic flight over McKinley's Muldrow and Traleika Glaciers in June of 1945. The United States Coast and Geodetic Survey utilized these

---

[152] Bradford Washburn, "A New Map of Mount McKinley, Alaska: The Story of a Cartographic Project," *The Geographical Review* 51 (April 1961): 160.

single-lens vertical photographs and Washburn's McKinley control data to create the first detailed large-scale map of the region between Mt. Brooks and McKinley. Although this map was never published, the project "strengthened [Washburn's] interest in making a thorough attack on this whole area."[153] Throughout the next fifteen years, Washburn would return often to the mountain, expanding his initial survey to encompass the entire McKinley massif. In 1960, he completed his survey work and produced, with the Swiss Institute for Alpine Research, the most visually aesthetic and strikingly accurate topographic representation of Mount McKinley published to date.[154]

Washburn's wartime expeditions to and survey work in the McKinley region crystallized his relationship with the mountain and provided the foundation from which he would develop a lifelong interest in studying McKinley's unique landscape, environment and history. In the post-war era, Washburn would climb McKinley twice more, utilize its geographic location to advance scientific research, produce the authoritative map of the mountain, become the foremost authority on the region's history and topography and entice an army of McKinley mountaineers to attempt new and more

---

153 Ibid.

154 Ibid., 161. See "Elevation of Mt. McKinley," *Military Engineer* 48 (1956): 384.

difficult ascents. By 1960, Washburn's personal and scientific involvement with Mount McKinley was so intimate and interwoven that he now shared with the mountain a significant portion of his own identity and personality. The following chapter will explore these themes and discuss the significance of Washburn's research on and study of the Mount McKinley region.

CHAPTER 4

A MOUNTAIN OF SCIENCE

THE LANDSCAPE OF HEIGHTS

Following World War II, Bradford Washburn returned to Boston and resumed his duties as Director of the Museum of Science. Although he continued to rebuild the museum, his passion for geographic exploration throughout the McKinley region again lured him North. Indeed, the Alaskan military field expeditions in which he participated afforded him significant experience and knowledge of the Mount McKinley area. As previously noted, in 1945, Washburn effected, the first "modern" survey of this area and already by 1936 had carried out a systematic photographic reconnaissance of the mountain from the air. At the close of the war, at 35, Washburn had become an authority on the mountain's geology, geography and history -- a distinction he would solidify in the coming decades.[1] This chapter will discuss and analyze

[1] Throughout his career, Washburn has published a wide range of popular and scholarly articles. His work has appeared in such popular publications as the *National Geographic*

Washburn's post-war geographic and scientific explorations along the slopes of Mount McKinley. By focusing on one of several Washburn McKinley expeditions, the ways in which he orchestrated disparate entities such as the US military (intent on winning the Cold War),the National Geographic Society and RKO Pictures to complete a broad range of geographic and cartographic studies along the slopes of Mount McKinley will be examined.

With end of the Second World War came the dawn of the American-Soviet Cold War, a period lasting nearly five decades. Throughout this time, significant funding was available for thousands of military scientific research and development programs. Historian Stuart W. Leslie argued that the Cold War "redefined American Science." He noted that in the decade following World War Two, the Department of Defense "became the biggest single patron of American

---

Magazine, *Life* and the *American Alpine Journal*. More scholarly work on the subject of Morainic Banding has appeared in the *Bulletin of the American Geological Society of America* (a co-authored work with Richard Goldthwait was appeared in the same publication on the movement of the South Crillon Clacier, Alaska), *The Royal Geographical Journal* and the *Dennison University Bulletin* (co-authored an aricle on surveying with Harvard Geologist Kirtley Mather). Washburn has also worked with a number of the world's most celebrated scientists and cartographers including Harvard astophysicist Harlow Shapley, University of Chicago physicist Marcel Schein and renowned cartograther Erwin Raisz.

science, predominantly in the physical sciences and engineering but important in many of the natural and social sciences as well."[2] On this subject, historian of science Harvey Sapolsky noted: "Collectively, military agencies were the main federal sponsors of university-based research in the initial years after World War 11."[3] Washburn was cognizant of the importance of military related research and that funding for such endeavors eclipsed all other potential patrons. Therefore, he positioned himself to reap the benefits of a mutually beneficial relationship with U.S. military agencies. This chapter will also explore Washburn's significant role as enabler in these collaborative relationships and how these partnerships made his numerous mapping and mountaineering expeditions to Mount McKinley possible.

The early history of geographic exploration throughout the McKinley region is well documented. However, a review of this work will provide the context and framework for this chapter.[4] Moreover, it will make clear that Washburn has

[2] Stuart Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993), 1.
[3] Harvey M. Sapolsky, "Academic Science and the Military: The Years Since the Second World War," in *The Sciences in the American Context: New Perspectives*, 379.
[4] See, for instance Terris Moore, *Mount McKinely; The Pioneer Climbs*; and William Brown, *A History of the Denali-*

created a bridge from late nineteenth century McKinley explorers to those of the twentieth century. It is interesting to note that Washburn was to mid to late twentieth century McKinley explorers what William Field was to turn of the century field glaciolgists in Southeast Alaska.[5]

Mount McKinley, the tallest mountain in North America, rises over twenty thousand feet above sea level and is the monarch of the Alaska Range.[6] These mountains, which constitute a great arc of glaciated peaks stretching from the Canadian border in the east to the Aleutian Range in southwestern Alaska, are composed of Cretaceous and Paleozoic rock, as well as granite batholiths intruded into volcanic and sedimentary rock.[7] The Range blocks and captures the

---

Mount McKinley Region, Alaska (Santa Fe: National Park Service, 1991): in particular, see 1-58.

[5] The significance of William Field's glacial research in Southeast Alaska in the early twentieth century, and its impact on expeditionary scientists, in particular Bradford Washburn, was discussed in chapter two.

[6] In 1866 Boston scientist and naturalist William Dall explored the interior of Alaska, then Russian-America. With English artist Frederick Wymper, Dall noted the vast mountain range in the territory's interior. He named this extensive chain of glaciated peaks the "Alaskan Range," now referred to as the Alaska Range. See William H. Dall, *Alaska and Its Resources* (Boston: Lee and Shepard, 1870), 286.

[7] Clyde Wahrhaftig, "The Alaska Range," in Howel Williams, ed., *Landscapes of Alaska: Their Geologic Evolution* (Berkeley: University of California Press, 1958), 48. See

relatively warm and moisture-laden air of the Pacific Ocean, taking from it nearly all of its precipitation before it proceeds on to Alaska's vast interior. As a result, glaciers along the southern slopes are much larger than those situated on its northern flanks.[8] The landscape immediatly surrounding Mount McKinley has been shaped by two distinct glacial episodes. The first event was the Healy Glaciation, which occurred during the Wisconsin Glaciation, 70,000 years ago. It was marked by a significant build up and advance of the Alaska Range's southern glaciers, forming a massive ice field that covered a considerable portion of southern Alaska. The Riley Creek Glaciation, which occurred during

---

also William Field, *Mountain Glaciers of the Northern Hemisphere*, 574; Thomas Griffiths, "Glacial Geomorphology on the Mt. McKinley Massif, Alaska," *Proceedings of the VIIIth General Assembly-XVIIth Congress, International Geographical Union*, rprt., (1952):331-336.

[8] Scott A. Elias, *The Ice-Age History of Alaskan National Parks* (Washington, D.C.: Smithsonian Institution Press, 1995), 61-62. For a review of early glacial observations along the Alaska Range see, for instance, Alfred H. Brooks, "A Reconnaissance in the Tanana and White River Basins, Alaska, in 1898," in United States Geological Survey, *20th Annual Report, VIII: Explorations in Alaska in 1898* (Washington, D.C.: Government Printing Office, 1900), 425-494; Alfred H. Brooks, "Mountain Exploration in Alaska," *Alpina Americana* 3, 1-22, (*Alpina Americana* was the journal of the then newly formed American Alpine Club. It has since been renamed *American Alpine Journal*); Alfred H. Brooks, "The Mount McKinley Region, Alaska," *United States Geological Survey Professional Paper 70*, (Washington, D.C.: Government Printing Office, 1911), 125-129.

the late Wisconsin period between 25,000 and 9,500 years ago, although less dramatic than its predecessor, also played a considerable role in carving this landscape.[9]

As a result of these ice-age epochs, the region surrounding Mount McKinley, with its glacial carved valleys, mosquito infested taiga and ice-clad peaks, posed a considerable challenge to European explorers.[10] After Bering's discovery of the mainland of Alaska in 1741, exploration by Russian fur traders began to slowly venture inland, uncovering an increasingly mysterious landscape. Although Native Alaskans had known for a long time of the magnificent mountain that dominated the Alaska Range, at that time no white man had seen the great peak.[11] During the late eighteenth century, the vast interior of then Russian-America was largely

---

[9] Scott A. Elias, *The Ice-Age History of Alaskan National Parks*, 64-70.

[10] In sharp contrast, Native Alaskans had long traveled ancestral trails throughout the Alaska Range. See James Kari, "The Tenada-Denali-Mount McKinley Controversy," *Names* 34, no. 3 (September 1986): 349.

[11] For a discussion of Native typonomy related to Mount McKinley and the McKinley region, as well as the long-standing controversy regarding such issues, see James Kari, ibid. 347-351. The most popular and perhaps most accepted indigenous name for the peak is Denali. For the creation legend of Denali, see James Wickersham, "The Creation of Denali, (Mount McKinley), By Yako, the Athabascan Adam: A Legend of the Yukon Tena Indians," *Alaska Magazine* 1, no. 1 (January 1927), 1-10.

unknown, and its spectacular inland mountains were yet to be explored. In 1794, British navigator and explorer George Vancouver, anchored in what is now known as Knik Arm, noted, "distant stupendous mountain covered with snow and apparently detached from one another; though possibly they might be connected by land of insufficient height to interrupt our horizon."[12] This statement has been accepted by a number of McKinley historians as the first documented reference to Mount McKinley and its companion peak, Mount Foraker.[13]

Russian expansion throughout Alaska during the late eighteenth and early nineteenth century continued inland from the rich marine coastline. By the 1830's, great volumes of information related to Alaska's geography had been collected by fur traders of the Russian American Company. These efforts were coordinated and directed by the Russian Governor of Alaska, Baron Ferdinand P. Von Wrangell, who relayed information from his many traders back to St. Petersburg, Russia for publication. In 1834 one such trader, Andrei Glazunov, documented a great mountain "called

---

[12] George Vancouver, *Voyages of Discovery...*,210-211.
[13] See, for instance Francis Farquhar, "The Exploration and First Ascents of Mount McKinley," *Sierra Club Bulletin* (June 1949):95; Terris Moore, *Mount McKinley; The Pioneer Climbs*, 1.

Tenada," which is clearly depicted on Wrangell's 1839 map of Russian America.[14]

Russian interest in Alaska dwindled in the mid-nineteenth century and, as a matter of course, little additional exploration of Alaska took place. Indeed, following the transfer of Alaska from Russia to the United States in 1867, there was little impetus for the U.S. to explore their newly acquired territory. It was left to the hardy prospector, driven by the promise of north's rich gold fields, to ascertain the topography of the Mount McKinley region. It is to this group of pioneers, Alaska geologist Alfred Brooks noted, "that we owe our extension of geographic

[14] Ferdinand P. von Wrangell, *Statistiche und Ethnographishe Nachrichten uber die Russischen Bestzungen an der Nordewestkuste von Amerika* (St. Petersburg: Imperial Academy of Sciences, 1839). For a description of Gluznov's reference to Mount McKinley and ensuing expedition, see pages 137-160. Wrangell's map, which identifies for the first time the location of Mount McKinley, Mount Foraker and the Alaska Range, see page 322. I thank Dr. Terris Moore for assistance in the translation of this document and for detailed discussions related to this topic. Additional explorations were made to the McKinley region and references as to the mountain's location were made. For instance, C. Grewingk included the Alaska Range, referred to then as the Tehigmit Mountains, on a map published in the 1850's. See C. Grewingk, *Beitrage zur Kenntniss der orographischen und geognostischen Beschafenheit der Nordwest Kuste Amerikas*, in Alfred H. Brooks, *The Mount McKinley Region, Alaska* (Washington, D.C.: Government Printing Office, 1911), 24.

knowledge."[15] Indeed, in 1878, a small group of prospectors ascended the Tanana River and camped along the shores of what today is known as the city of Fairbanks. Here, the men discovered alluvial gold and noted large snow-capped peaks to the south, a reference to the Alaska Range and Mount McKinley.[16]

Miners explored and tested their luck throughout the territory in the latter nineteenth century and, with such activities, came the necessity for an increased U.S. military presence. Army reconnaissance expeditions were detailed to numerous Alaskan locations and several made early explorations of the McKinley region. In 1885, Lieutenant Henry Allen led an expedition to the McKinley area and noted that the Alaska Range comprised some "very high snow clad peaks."[17] In 1889, prospector Frank Densmore so praised McKinley's grandeur so much that fellow miners

---

[15] Alfred Brooks, *The Mount McKinley Region, Alaska*, 24. This group of men included Alfred Mayo and Arthur Harper.
[16] Terris Moore, *The Pioneer Climbs of Mount McKinley*, 8. Arthur Harper was the father of Walter Harper, the first man to set foot on the summit of Mount McKinley as a member of Hudson Stuck's 1913 ascent of McKinley's taller south peak. See Hudson Stuck, *The Ascent of Denali: A Narrative of the First Complete Ascent of the Highest Peak in North America* (Nebraska: University of Nebraska Press, 1914).
[17] Henry Allen, *Report of an Expedition to the Copper, Tanana and Koyukuk Rivers, in the Territory of Alaska* (Washington, D.C.: Government Printing Office, 1887), 69.

christened the peak Densmore's Mountain.[18] In 1894 gold was found south of the Alaska Range, in the Cook Inlet area, and this brought even more miners to Alaska. Eventually, they traveled north in great numbers, toward the Alaska Range and McKinley, and, by doing so, undoubtedly gained rich geographic knowledge of the area. However, by the very nature of their trade, miners generally were less than forthcoming in matters pertaining to geology and geography. Perhaps this is why word of Densmore's great peak did not attract any significant public attention.

The lure of Alaska gold attracted, William Dickey, a Princeton educated prospector, who worked his way from Cook Inlet to the lowlands surrounding McKinley. It was Dickey's account of the 1896 field season, published in the *New York Sun*, that first brought public attention to the peak. In this article he claimed that the peak was the "highest in North America," and estimated it to be "over 20,000 feet high."[19] Dickey also gave the name to the mountain the name,

---

[18] Josiah Spurr, "A Reconnaissance in Southeastern Alaska in 1898," *Twentieth Annual Report of the United States Geological Survey*, 7 (Washington, D.C.: Government Printing Office, 1900), 95; Alfred Brooks, *The Mount McKinley Region*, Alaska, 25.
[19] William Dickey, "Discoveries in Alaska," *New York Sun*, Sunday 24 January 1897. For a reprinted version of Dickey's account, see William Dickey, "Discoveries in Alaska (1896)" in *American Alpine Journal*, (1951-1953). For a specific

by which it is now known: "We named our great peak Mount McKinley," Dickey wrote, "after William McKinley of Ohio, who had first been nominated for the Presidency, and that fact was the first news we received on our way out of that wonderful wilderness."[20]

Although Dickey's report drew some public and government attention to McKinley and Alaska's interior, it was the discovery of gold in the Klondike that placed the territory and its considerable mineral resources in the forefront of political thought and agendas. Financial appropriations were made to the United States Geological Survey (USGS) that

---

reference to the height of the mountain, see page 131. Dickey's map indicating the location and height of McKinley is reprinted in Terris Moore, *Mount McKinley; The Pioneer Climbs*, 16.

[20] Ibid. As previously noted in the body of this chapter, there continues to rage a controversy over the appropriate name for Mount McKinley. As James Kari points out, Alaska Native peoples have long referred to the mountain by several traditional names. In addition to Mount McKinley, the peak possesses another "official" name, bestowed upon it in 1965. With the death of British statesman Sir Winston Churchill, President Lyndon Johnson honored the former Prime Minister of England by naming the twin summits of the mountain "Churchill Peaks." This little known fact can be seen in current USGS maps of the mountain which place "Churchill Peaks" between the two summits of massif. See "Office of the White House Press Secretary," press release, 23 October 1965, Lyndon Baines Johnson Collection, file PA2/Winston Churchill, Lyndon Baines Johnson Library, Austin, Texas; Mike Sfraga, "A Mountain of Names," forthcoming.

began a series of systematic explorations and surveys throughout Alaska including the McKinley region.[21] Six USGS parties were dispatched to Alaska in the summer 1898, four of which traversed the environs surrounding the mountain.[22] George Eldridge led one such expedition on which topographer Robert Muldrow made the first "scientific" calculation of the mountain's height, finding it to be 20,464 feet tall. Muldrow's computations supported Dickey's assertion that the peak was indeed the continent's tallest peak.[23] Additional

---

[21] Morgan Sherwood, *Exploration of Alaska: 1865-1900*, 171-172; Mary Rabbitt, *Minerals, Lands and Geology for the Common Defence and General Welfare 2: 1879-1904* (Washington, D.C.: Government Printing Office, 1980), 280-283.

[22] Ibid.; Alfred Brooks, *The Mount McKinley Region, Alaska*, 27.

[23] George Eldridge, "A Reconnaissance on the Sushitna Basin and Adjacent Territory, Alaska, in 1898," *Twentieth Annual Report of the United States Geological Survey*, 7 (Washington D.C.: Government Printing Office, 1898-1899), 8. Muldrow's diary refers to Mount McKinley by its Russian name, Mt. Bulshia (also known on several Russian maps as Bulshia Gora, meaning either Big Mountain or Great Mountain). His personal notes indicate the following initial computation of the mountain's height: "Located Mt. Bulshia. Ela. {sic} over 19,000 feet. Ela. {sic} Mt. Bulshia over 19,000. Highest Mt. {sic} in America." See Henry Lowndes Muldrow, *U.S. Geological Survey Expedition to Alaska 1898*,D. The diary was given to Bradford Washburn by the Muldrow family and is included in the BWPP to be deposited in the Bradford Washburn Collection at the University of Alaska Fairbanks. In the same year, a USGS party led by Josiah Spurr made the first crossing of the Alaska Range on which Spurr noted: "marvelous-appearing mountains... I would not be surprised if they were among the highest in the world." Many years later Spurr recalled the exciting fact that his expedition

reconnaissance expeditions were dispatched by the USGS and the War Department during the summers of 1898 and 1899, each of which added significantly to the geographic understanding of the McKinley landscape.[24]

The exploring parties of 1888 and 1889 provided the foundation from which future scientific expeditions would rely. In 1902, Alfred Brooks of the USGS explored from Cook

---

had "seen the highest mountain in North America (McKinley), the position and altitude {sic} of which were determined during the same summer by the Eldridge-Muldrow party." See Josiah Spurr and Stephen H. Spurr, *The Log of the Kuskokwim: An Exploration in Alaska* (Spurr: Petersham, 1950), 23.

[24] The War Department dispatched Lieutenant F.W. Glenn and USGS field geologist William Mendenhall to Alaska. The later carried out numerous geologic and topographic surveys along the Alaska Range. Their subsequent report greatly expanded the geographic understanding of the area. See William Mendenhall, "A Reconnaissance From Resurrection Bay to Tanana River, Alaska," *Twentieth Annual Report of the United States Geological Survey* 7 (Washington, D.C.: Government Printing Office, 1900), 265-340. Also under orders to explore various areas adjacent to McKinley were Lieutenant J. Castner; See J.C. Castner "A Story of Hardship and Suffering in Alaska," in *Compilation of Narratives of Exploration in Alaska* (Washington, D.C.: Government Printing Office, 1900), 686-709. In 1899 Lieutenant Joseph Herron, in search of an all-American route to the Klondike, explored the unknown region between the area traversed by both Spurr (along the Kuskokwim) and Allen (along the Tanana) and produced a map detailing the area he covered. See, Joseph Herron, *Explorations in Alaska, 1899* (Washington, D.C.: War Department, 1899). On this expedition Herron named Mount Foraker, the adjacent tall peak to Mount McKinley. See Francis Farquhar, "Naming Alaska's Mountains," *American Alpine Journal*, 211-212.

Inlet to the Yukon River. Brooks' reconnaissance, which lasted two months and covered 800 miles, connected with previous surveys in the region and carried out the first detailed mapping and exploration of the foothills surrounding McKinley. In August of that year, Brooks became the first documented white man to set foot on the mountain's slopes.[25]

In addition to the vast amount of geographic, geologic and topographic information the expedition collected, news of

---

[25] Alfred Brooks, "An Exploration to Mount McKinley, America's Highest Mountain," *Smithsonian Institution Annual Report 1903* (Washington, D.C.: Government Printing Office, 1904), 407-425. Brooks' reference to first setting foot on the mountain is noted on pages 420-421. Here he writes: "My objective was a shoulder of the mountain about 10,000 feet high." However, he soon was convinced that it would be "foolhardy, alone as I was, to attempt to reach the shoulder for which I was headed, at 7,500 feet I turned and cautiously retraced my steps, finding the descent to bare ground more perilous than the ascent." At his highest point, Brooks left a record of the ascent: "On a prominent cliff near the base of the glacier on which I had turned back I built a cairn, in which I buried a cartridge shell from my pistol, containing a brief account of the journey, together with a roster of the party." This note was found nearly five decades later by John Reed. See, John C. Reed, "Record of the First Approach to Mt. McKinley," *American Alpine Journal*, (1955): 78-83. A detailed sketch map of the Alaska Range and the expedition's route was prepared by Brooks and soon became an invaluable resource for subsequent USGS parties and several groups of adventurous mountaineers. Brooks' map is found on page 410 of "An Exploration to Mount McKinley, America's Highest Mountain."

Brooks' "ascent" in the McKinley foothills drew considerable public attention which, he later wrote, "caused popular interest in the results of the expedition out of proportion to their importance." Brooks recalled that, "an intense curiosity sprang up" among mountaineers regarding a feasible route to the mountain's summit. To satisfy this demand "an article was published outlining briefly what appeared to be the most feasible routes to the base of the mountain."[26] Brooks recommended a northern approach, claiming that a southern route from Cook Inlet would be far too long. Within months of Brooks' publication, two mountaineering parties set out to try to climb the mountain for the very first time.[27]

THE MOUNTAINEERS ARRIVE

The first of these expeditions to attempt to climb the mountain was from Fairbanks (by way of Nenana) and led by

---

[26] Alfred Brooks, "The Mount McKinley Region, Alaska," 29. Brooks and D.L. Raeburn published "Plan for Climbing Mt. McKinley," *National Geographic Magazine,* January 1903, 30-35.

[27] It is interesting to note that eleven expeditions attempted McKinley during the decade following Brooks' recommendations for climbing the mountain. None of the parties attempting the mountain from the south succeeded, while three of the four which progressed from the north were, collectively, able to establish a feasible route - which ultimately led to the first ascent in 1913.

Alaska District Judge James Wickersham in May, 1903. Although Wickersham's expedition failed to reach the summit, they did reach an elevation of ten thousand feet on the mountain's avalanche-strewn north wall and documented many important topographical features.[28] Just two months after Wickersham's expedition departed, Dr. Frederick Cook, a New York physician and veteran of several polar expeditions, led a Harpers Magazine sponsored expedition to the mountain. Although Cook's party failed to reach the summit, they did attain a height of about one thousand feet higher than Wickersham. Cook also carried out an impressive circumnavigation of the peak. Throughout the trip, Cook's expedition collected a considerable amount of geographic information that greatly increased the understanding surrounding the mountain. Cook's expedition was fraught with personal conflict, however, and extensive literature exists on this subject.[29]

---

[28] James Wickersham, *Old Yukon: Tales, Trails and Trials* (Washington, D.C.: Washington Law Book Co., 1938), 203-320. The north wall, on which Wickersham climbed, has long been referred to by mountaineers as the "Wickersham Wall."
[29] For an account of Cook's 1903 expedition, see Frederick A. Cook, "American's Unconquered Mountain," parts I and II, *Harpers Monthly Magazine*, January and February 1904. An account of the 1903 expedition is also included in Frederick A. Cook, *To the Top of the Continent* (London: Hodder & Stoughton, 1909), 1-91. See also a series of articles in the *Outing Magazine* written by Harvard educated writer and expedition member, Robert Dunn, "Across the Forbidden Tundra," January 1904, "Into the Mists of Mt. McKinley,"

In 1906, Dr. Cook returned to Mt. McKinley and claimed to have made the first ascent of the peak with companion Ed Barrill. Cook's claim came under immediate suspicion from many mountaineers and polar explorers. This issue has generated volumes of literature and books and articles have been printed on a rather regular basis. Although this was a significant event in the history of Mount McKinley exploration, this subject or the subsequent controversy which has now raged for nine decades will not be detailed here. Several sources are cited for those who wish further information on the issue.[30] Following Dr. Cook's assertion, other expeditions attempted the mountain. However, none of them succeeded in reaching the summit until summer of 1913 when the Reverend Hudson Stuck's expedition approached the

---

February, 1904, "Storm-Wrapped on Mt. McKinley," March, 1904, "Highest on Mt. McKinley," April, 1904, "Home by Ice and by Swimming from Mt. McKinley," May, 1904; Dunn's highly critical account of Dr. Cook's leadership and climbing skills is documented in Robert Dunn, *Shameless Diary of an Explorer* (New York: The Outing Publishing Co., 1907).

[30] Frederick A. Cook, *To the Top of the Continent - Discovery, Exploration and Adventure in Sub-Arctic Alaska: The First Ascent of Mt. McKinley 1903-1906* (New York: 1908); Frederick A. Cook, "The Conquest of Mt. McKinley," *Harpers Monthly Magazine*, (May, 1907); Frederick A. Cook, *My Attainment of the Pole* (New York: The Polar Publishing Co., 1911); Belmore Browne, *The Conquest of Mount McKinley* (New York: 1913), of particular interest here are pages 68-72; Bradford Washburn, Adams Carter and Ann Carter, "Dr. Cook and Mount McKinley," *American Alpine Journal* (1958):1-30.

mountain. This expedition is widely held to be the first to have reached the mountain's true south summit.[31]

---

[31] Those expeditions which took place from the time of Wickersham to that of Hudson Stuck, brought back rich geographic and topographic information regarding Mt. McKinley and its surrounding environment. The Sourdough Expedition of 1910 scaled McKinley's shorter North Peak. See, for instance, *New York Sun*, "Four Climb Mt. McKinley," 13 April, 1910, p. 1-2. The expedition's success was questioned due to the rather exaggerated claims of the team's organizer Thomas Lloyd - who himself did not reach the North Peak; See Claud E. Rusk, "On the Trail of Trail of Dr. Cook," *The Pacific Monthly* ,January 1911. Reference to Lloyd and the Sourdough Expedition is made on page 62. For a detailed review of the expedition and subsequent controversy, see Terrence Cole, *The Sourdough Expedition* (Anchorage: Alaska Journal, 1985). In 1910 an expedition led by the Oregon Mountaineering Club - the Mazama, endeavored to retrace Dr. Cook's 1906 expedition and by doing so, prove Cook's claim to be true. Yet, the team railed to do so and dismissed his ascent as impossible. See Claud E. Rusk, "On the Trail of Dr. Cook," *The Pacific Monthly*, parts 2 and 3, November 1910 and January 1911. In 1910 Belmore Browne and Herchel Parker, both members of Dr. Cook's 1906 expedition, returned to the mountain and photographed a small peak, nearly 2 miles distant from the true summit of McKinley - matching this peak to the one which Dr. Cook offered as "the summit" of Mt. McKinley. This proof is reproduced in Browne's book, cited in this footnote on page 122a. Two expeditions attempted the mountain in 1912, neither one attaining the summit; see Belmore Browne, *Conquest of Mount McKinley*. The *Fairbanks Daily Times expedition*, led by Ralph Cairns, also failed to reach the summit. See *Fairbanks Daily Times*, "Time's Expedition Enroute M'Kinley," p. 1; Ralph Cairns "Hazards of Climbing Mount McKinley," *Overland Monthly*, February 1913. The first ascent of McKinley is documented in Hudson Stuck, *The Ascent of Denali*.

Following Stuck's ascent, the mountain remained unchallenged for nearly two decades. This was in part due to the conquest of the great peak, the outbreak of World War I and the Great Depression. However, in the summer of 1932, two teams challenged the peak, one sporting in nature and the other an ambitious scientific expedition. The Lindley-Liek Expedition was indeed a ski expedition, intent on making the second ascent of the mountain. But the 1932 Cosmic Ray Expedition, led by premier American mountaineer and Bell Telephone Laboratories engineer, Allen Carpe', was engaged in path-breaking cosmic ray research. The summit was secondary to the collection of scientific data needed to understand this mysterious form of celestial radiation.

COSMIC RAYS AND THE MOUNTAIN LANDSCAPE

Allen Carpe' had undertaken, with renowned Chicago University physicist Dr. Arthur H. Compton, a collaborative research project, which, he explained to friend and colleague Francis Farquhar, "will be carrying out measurements at high elevations on Mount McKinley." He indicated that initial measurements need not be made higher than 11,000 feet and such data would be added to that which was currently being collected by Compton "for a wide program of investigations of cosmic rays at high elevations in different parts of the earth."[32]

Throughout the 1920's and 1930's, physicists were engaged in a most compelling problem regarding the nature of cosmic rays, discovered in 1912 by Austrian physicist Victor F. Hess. The origins of cosmic rays was unknown and even controversial during the inter-war years which followed their discovery.[33] Hess' discovery of a strange form of sub-atomic radiation, whose energy far exceeded that of any known form of terrestrial radiation, was subsequently confirmed by German physicist W. Kohlhorster in the years 1913-1919. Kohlhorster, like Hess, utilized a hot air balloon and ascended to an altitude of 28,000 feet where he noticed a correlation between the increased strength of cosmic ray radiation with an increase in altitude. However,

---

[32] Allen Carpe' to Francis Farquhar, 10 January, 1932, quoted in Terris Moore, *Mount McKinley: The Pioneer Climbs*, 122.

[33] Bruno Rossi, *Cosmic Rays* (New York: McGraw-Hill Book Company, 1964), 2. In 1912 Hess ascended to 16,000 feet in a hot air balloon and recorded, with electroscopes, data which indicated "radiation of very great penetrating power {which} enters our atmosphere from above." Quoted in ibid. The literature on cosmic rays is quite extensive. See, for instance, Yataro Sekido and Harry Elliot, *Early History of Cosmic Rays: Personal Reminiscences with Old Photographs* (Dordrecht: D. Reidel Publishing Company, 1985); Louis Laprince-Ringuet, *Cosmic Rays*, Trans., Fay Ajzenberg (New York: Prentice Hall, 1950).

some physicists, like Robert Millikan of the California Institute of Technology, were hesitant to accept the the results.

Therefore, Millikan carried out a comprehensive research program from 1923-1926 to verify the existence of cosmic rays. This work was undertaken in a variety of environments and mediums including on high alpine lakes, at various depths in the ocean and, by utilizing unmanned sounding balloons, high in the upper atmosphere. As physicist Bruno Rossi noted, "Millikan's experiments convinced himself and nearly everyone else in the scientific community that the radiation discovered by Hess did come from beyond the earth's atmosphere. And it was Millikan who gave the name Cosmic Rays to their radiation."[34] The nature of cosmic rays intrigued and challenged scientists because the very existence and characteristics of this celestial radiation needed to be explained and incorporated into current day theoretical atomic models.

---

[34] Bruno Rossi, *Cosmic Rays*, 8-9. Unlike Hess, Millikan employed unmanned sounding ballons equiped with electroscopes which recorded the radiation bombardment in Earth's upper atmosphere. It should be noted that Millikan's techniques were later refined and employeed by German physicist Erich Regener - which allowed for more accurate readings. For a hisorical overwiew see also David Devorkin, *Science With a Vengeance: How the Military Created the US Space Sciences After World War II*, 15.

By the early 1930's, two beliefs were widely accepted regarding cosmic rays. First, and foremost, their existence had been confirmed and second, the strength of their radiation increased with altitude. However, there existed a question as to whether or not the intensity of cosmic rays increased or decreased with a change in latitude. Millikan contended that latitude had no effect on the strength of radiation while Chicago University physicist Arthur Compton held an opposing view. Compton believed that the intensity and strength of cosmic rays would indeed increase or decrease relative to latitude.

In 1932, Compton set out to confirm his theory by organizing a global research program to measure the strength of cosmic rays. Sixty-nine research stations were established by eight field expeditions throughout several geographically diverse regions. Allen Carpe's 1932 Mount McKinley Cosmic Ray expedition was a one component of this program.[35] This

---

[35] Carpe's expedition and scientific investigation tragically ended when both Carpe' and companion Theodore Koven died following a fall into a crevasse on the Muldrow Glacier. Although their research was not complete, the data was retrieved and forwarded to Compton by members of the Lindley-Liek expedition who had just completed the second ascent of the peak. See, *New York Times*, "Lindley Expedition Scales Mt. M'Kinley; Descending, Finds Carpe and Koven Dead; Young Scientists Fell Into a Crevasse," 17 May 1932, p. 1;

research, noted Compton, indicated a "rapid increase with altitude noted by previous observers... but also the fact that at each altitude the intensity is greater for higher latitudes than near the equator."[36] The findings also indicated that cosmic rays were charged particles, a notion held by Compton but contested by Millikan, who believed that cosmic rays were photons. If Millikan were to accept Compton's findings, then such charged particles would be distributed unevenly around the earth by the planet's magnetic field and, as historian David Kevles points out, "the intensity of cosmic rays would vary with latitude," a notion Millikan continually dismissed.[37]

New York Times, "Carpe, Koven Died In a Feat of Daring," 18 May 1932, p.1, 12. Edward Beckwith, "The Mt. McKinley Cosmic Ray Expedition, 1932," *American Alpine Journal* (1933): 45-68. "'Cosmic Ray' Party Comes to Grief," *Park Service Bulletin* 2, no. 4, June 1932.

[36] Arthur Compton, "A Geographic Study of Cosmic Rays," *The Physical Review* 43, no. 6 (15 March 1933): 387. In addition to Carpe's Mount McKinley Expedition in Alaska, other high altitude networks were set up around the world, such as Colorado, Switzerland, Peru, Mexico, Hawaii, South Africa, Panama and New Zealand. Ibid., 388. For additional discussion on what has come to be known as the "Latitude Effect," see Arthur Compton, "Cosmic Rays as Electrical Particles," *The Physical Review* 50 (15 December 1936):1119-1120; Bruno Rossi, *Cosmic Rays*, 73-75. According to A. M. Hillas, 1932 was "selected as an international "magnetic year." See A.M. Hillas, *Cosmic Rays* (Oxford: Pergamon Press, 1972), 14.

[37] Arthur Compton, "A Geographic Study of Cosmic Rays," 387-403; Daniel J. Kevles, *The Physicists: The History of a*

Throughout the 1930's, physicists continued to study the atom and they found that cosmic rays were an excellent means by which matter could be probed. As David Devorkin noted, "everyone knew, however, that what they were catching in their detectors were not the original cosmic rays, called 'primaries'; but the secondary byproducts of the collisions of primaries with particles in the earth's atmosphere." Therefore, the study of primaries drew significant attention and was the subject of numerous research programs until such efforts were curtailed with the outbreak of World War II. With the end of the war and the emergence of the Cold War, however, significant research into cosmic ray radiation resumed.[38]

FROM HARVARD TO HOLLYWOOD

Bradford Washburn fully grasped the significance of obtaining a portion of the considerable amount of military funding and logistical support now available for expeditionary science. As previously discussed, Washburn's

---

Scientific Community in Modern America (Cambridge: Harvard University Press, 1995), 240-241.

[38] David Devorkin, *Science With a Vengeance: How the Military Created the US Space Sciences After World War II*, 15, 247.

extensive Alaskan field experience throughout the war relied upon the U.S. military for logistical support. Indeed, his first substantial attempt in surveying the Mount McKinley region in 1945 was made possible by the Army Air Force. When, in October of 1946, RKO Pictures executive Paul Hollister contacted Washburn to organize and lead a large-scale mountaineering expedition, it was to the military and the American scientific community that the two men looked for support and direction.

Hollister suggested to Washburn an expedition for the purpose of obtaining authentic mountaineering footage for a movie RKO was developing. Although the actual filming of the production was scheduled for the European Alps, the high altitude footage was needed.[39] Hollister first considered Mount Everest on which to carry out his plan, but Washburn convinced him that Mount McKinley would be a more feasible option due to its relative proximity to two Air Force Bases (in Anchorage and Fairbanks) in Alaska.[40] With McKinley agreed upon, Hollister and Washburn set out to create an attractive and legitimate program of theatrical and

---

[39] Jay Bonafield to Paul Hollister, 29 January 1947. Bradford Washburn Collection, Operation White Tower, box 3, file 1. Hereafter referred to as OWTF.
[40] Paul Hollister to Bradford Washburn, 7 October 1946, Ibid.

scientific significance. "The New England Museum agreed to undertake this project," Washburn later wrote, "provided that RKO made it financially possible for the museum to carry out a number of purely scientific objectives."[41]

In a confidential letter to Roy Larsen of *Life Magazine*, in which he explored possible media coverage for and joint collaboration in the expedition, Hollister explained that:

> Our own self-interest in offering the essential out-of-pocket costs is simply this: We own a book called The White Tower by James Ramsey Ullman, which has now sold upwards of 700,000 copies, which we are going to make into a distinguished picture -- and I mean distinguished. Its story concerns alpine climbing. The more often people can read about high mountain climbing, the more receptive the audience will be to our picture when it comes out. It's just that simple.[42]

However, Hollister believed that the expedition needed several "angles" on which it could be sold not only to the general public, but to the military and scientists whose

---

[41] Bradford Washburn, "Operation White Tower," undated post expedition report, OWTF, file 6, 1.
[42] Paul Hollister to Roy Larsen, 1 October 1946, OWTF. James Ramsey Ullman, *The White Tower* (Philadelphia: J.B. Lippincott Company, 1945).

support and expertise were vital to its success.[43] In an effort to lure public attention to the expedition and create pre-release interest in the movie, Washburn suggested the inclusion on the expedition of a woman. "You made a brilliant suggestion in wanting to get the first gal up there," Hollister wrote, "it seems to me that this would be publicity of the first magnitude." Hollister also suggested to Washburn that since the movie called for two actors to scale the mountain, "how would you like to take the leading male and or leading woman to the top of the goddamn mountain." He contended that "the man can do anything athletic that would be required. As to the girl, just assume that she has the usual equipment -- whatever that is." Yet he reassured Washburn that he was not "going publicity crazy," as this was a "serious venture" which must include all the "scientific or pseudo-scientific angles that will justify the venture in wide variety of directions." [44]

Although Hollister tried to emphasize the expedition as a "serious venture," his overriding motive clearly was in the pursuit of public relations. Nevertheless, he contacted Harvard astrophysicist and director of the Harvard College Observatory, Dr. Harlow Shapley, to explore the possibility

---

[43] Ibid.

[44] Paul Hollister to Bradford Washburn, 7 October 1946, OWTF.

of developing scientific components for the expedition. Hollister encouraged Washburn to "get into a closed room with him and ask him to suggest how many ways {the} expedition might make a real scientific contribution."[45] As Washburn later wrote, preliminary discussions with Shapley were productive: "He {Shapley} has some extremely practical ideas with regard to McKinley and is going to discuss them with a group of cosmic ray physicists."[46]

Shapley indicated to Washburn that RKO should concentrate their efforts on its film project and leave the scientific organization and direction for him {Shapley} to develop. "He {Shapely} believes that a considerable sum of money could be secured," Washburn noted, "either from a private foundation or from the Government for this enterprise."[47] Indeed, the Naval Research Laboratory (NRL) contended that research into cosmic rays posed a "practical application because cosmic radiation represents a potential hazard to operations of high-flying manned vehicles and to instrumentation, particularly transistors, to be used in earth satellites."[48]

---

[45] Ibid.
[46] Bradford Washburn to Paul Hollister, 14 October 1946, OWTF.
[47] Ibid.
[48] Dorrit Hoffleit, "Two Days and Thirteen Hours," 22 December 1946, 1-2, Dorrit Hoffleit private papers, quoted in David Devorkin, *Science With a Vengeance: How the*

Eventual support for the expedition's cosmic ray work was secured through the U.S. Navy's Office of Naval Research (ONR), founded in 1946, which granted considerable resources toward basic research.[49] From 1946 through 1950, which Sapolsky has deemed the "golden age of academic science," ONR was the primary federal agency supporting academic research. Indeed, a relatively remote and energetic expedition such as Washburn proposed fit well into ONR's research and funding mandates. "ONR was able to use public funds to support promising opportunities in science," Sapolsky noted, "free from the considerations of geography."[50] A confidential document, covering the

---

Military Created the US Space Sciences After World War II, 249.

[49] A. Hunter Dupree, *Science in the Federal Government: A History of Politics and Activities* (Baltimore: The Johns Hopkins University Press, 1986), 374. ONR support was secured through Navy contract N6ori, Task Order XVIII. See Thomas Carr, Marcel Schein and Ian Barbour, "Cosmic-Ray Investigation on Mt. McKinley," *The Physical Review* 73, no. 12, (15 June 1948): 1419.

[50] Bradford Washburn to Mike Sfraga, telephone conversation, 5 December 1996; Bradford Washburn, "Mapping Mt. McKinley," unpublished keynote address presented at the Alaska Surveyors Conference, Anchorage, Alaska, 11 March 1991, 10. BWPP. Harvey Saplosky, "Academic Science and the Military: The Years Since the Second World War," 386. The Office of Naval Research was the conduit through which a considerable amount of scientific research was funded during the years immediatly following World War II. For example, Sapolsky points out that even the "Atomic Energy Commission then used

activities of the Geophysics Branch of ONR during 1947-48, contained directives to support and sponsor field research expeditions to "relatively inaccessible areas of the Earth." ONR believed that such expeditions were an "outgrowth of Man's native curiosity," and a means by which we may "discover new principles which control our environment." The understanding and possible control of the environment was considered a high military priority and officials at ONR

ONR as its preferred mechanism for the support of university-based research" (Ibid). Moreover, ONR played a key role throughout the post-war years in establishing models for collaborative scientific research programs between universities and the U.S. government (Ibid), 380. The way in which science was organized and funded went through a significant transformation just prior to World War II. By 1940, new and dynamic research partnerships were formed between scientific communities, universities and government. Historian A. Hunter Dupree has called the creation of such partnerships and their subsequent arrangements for scientific investigations, the "Great Instauration of 1940." A. Hunter Dupree, "The Great Instauration of 1940," in Gerald Holton, ed., *The Twentieth Century Sciences: Studies in the Biography of Ideas*, 443-465. For additional discussion of the history of ONR, see for instance Harvey Sapolsky, ibid., 378-400. For a discussion as to ONR's research interests in and funding of cosmic ray research, as well as vehicles on which such experiments could be conducted, see, for instance, Daniel Kevles, *The Physicists: The History of a Scientific Community in Modern America*, 353-356, 363-364, 420-421; David DeVorkin, *Science With a Vengeance: How the Military Created the US Space Sciences After World War II*, 256-267; Stuart Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford*, 144-148.

believed that "the society which knows the most about its environment... is going to be more likely to win the next war." The final justification for continued ONR support of remote expeditions was one in which Washburn would have been in full agreement: "In addition to these reasons for expeditions but not the least in importance, expeditions are fun."[51]

While Shapley developed scientific options for the program, Washburn unveiled to Hollister a bold and multi-disciplinary plan which included a myriad of scientific objectives. He envisioned the McKinley program to be an ideal means by which he could continue his survey work of the mountain which he had initiated in 1945. One goal of this expedition, he wrote to Hollister, "in addition to the purely adventurous objectives of climbing the mountain, would be to obtain valuable survey data on its yet unmapped upper portion... and other scientific projects which might be proposed by Shapley."[52] He also suggested a series of reconnaissance and aerial photographic flights "to make

---

[51] "The Military Aspects of the Geophysics Branch Program," undated report, S10 Subject Files, Records, 1903-1981, box 26, 81-16, F.36. "U.S. Navy. Office of Naval Research, February 1947-1948," Scripps Institution of Oceanography Archives, University of San Diego, San Diego, California.
[52] Bradford Washburn to Paul Hollister, 16 October 1946, OWTF.

photographs to use in place of a map during the actual climb."[53]

Aerial re-supply of the expedition was to be made by military C-47 aircraft at 18,000 feet where a "comfortable camp could be parachuted so that the high altitude survey work and other projects... could be carried out from a reasonably warm and comfortable base." Moreover, large quantities of "scientific supplies could be chuted to the 18,000 ft. camp," where the "highest observatory ever established any where in the world" would be occupied."[54]

---

[53] In 1936 Washburn carried out the first systematic aerial photographic survey of Mount McKinley. The photographic work he suggested to Hollister would compliment and update his work of a decade earlier. See Bradford Washburn, "Over the Roof of the Continent," *National Geographic Magazine*, July 1938, 78-98. It should be noted that a detailed map of the mountain did not exist at this time. The U.S. Army's 1942 McKinley Expedition, on which Washburn participated (discussed in chapter 3), utilized both aerial photographs and a map prepared by Alfred H. Brooks during his 1902 McKinley Geological Survey expedition.

[54] Ibid. Although Washburn's proposed observatory was indeed the highest established in North America, the highest facility was located on the 19,200 foot summit of El Misti - a dormant South American volcano. The facility was utilized by scientists of the Harvard College Observatory for astronomical work. Scott Forbush of the Department of Terrestrial Magnetism carried out cosmic ray studies on the summit in the 1930's. See Scott Forbush, "Some Recollections of Experiences Associated with Cosmic-Ray Investigation," in Yataro Sekeido and Harry Elliot, ed,. *Early History of Cosmic Ray Studies: Personal Reminiscences With Old Photographs*, 174.

Washburn reassured Hollister that he and Shapley could create a project that is "interesting, dramatic, practical and distinguished. If you don't get $15,000 worth of mountain publicity out of it, I'd eat my flying suit."[55] RKO quickly approved Washburn's plan, and although details of the scientific components were still in discussion, the expedition was set to begin in the spring of 1947.[56]

On 31 October 1946, Washburn met with Harlow Shapley, Donald H. Menzel of Harvard and Bruno Rossi of the Massachusetts Institute of Technology, at the Harvard College Observatory to discuss viable high altitude research programs for the expedition.[57] Shapley reported that "neither the Harvard nor MIT cosmic ray men have a particular interest in the problems that could be tackled on Mount McKinley." However, several alternative suggestions were made, including the recruitment of Professor Ira A. Bowen and Dr. Harold Babcock

---

[55] Ibid. Washburn projected that the expedition could be accomplished for the sum of $15,000.
[56] On 20 January 1947, a written contract between RKO Pictures and Bradford Washburn established the New England Museum Alaskan Expedition 1947, Inc., OWTF, file 6.
[57] It should be noted that Donald Menzel replaced Shapley as Director of the Harvard College Observatory in the early 1950's. In 1939, Menzel founded the High Altitude Observatory in Climax, Colorado. See Ronald Doel, "Redefining a Mission: The Smithsonian Astrophysical Observatory on the Move," *Journal for the History of Astronomy* 21 (1990): 139-152, see page 140.

of the Mount Wilson Observatories who were "working with Millikan on studies related to the magnetic field of the sun and high altitude in high latitudes." Shapley also indicated that "Professor Marcel Schein of Chicago University would have an interest in this direction."[58]

Indeed, Schein found the opportunity appealing and notified Shapley of his thoughts on the subject:

> I have in mind an experiment on the production of mesotrons which has to be carried out with a system of counter telescopes. There is a chance that in addition we might be able to fix up some ionization chambers for investigation of giant atmospheric showers. We also could send along some photographic plates for measuring the frequency of nuclear disintegration (stars) caused by cosmic particles.[59]

Prior to World War II, Schein made the first observations of highly accelerated protons, believed to be the elusive cosmic ray primaries.[60] Although Schein preferred the use of

---

[58] Harlow Shapley to Paul Hollister, 31 October 1946, OWTF, file 1.

[59] Marcel Schein to Harlow Shapley, 3 December 1946, OWTF, file 3.

[60] Marcel Schein, William Jesse and E.D. Wollen, "Intensity and Rate of Production of Mesotrons in the Stratosphere," *Physical Review* 57, (1940): 847-854.; Marcel Schein, William Jesse, and E.D. Wollan, "The Nature of the Primary Cosmic Radiation and the Origin of the Mesotron," *The Physical Review* 69 (1941): 615.

balloons and aircraft in such research, he nevertheless saw the benefits of establishing a stationary high-altitude research hut on McKinley which was capable of obtaining data over a prolonged period of time.[61] Plans for the cosmic ray work, under the direction of Schein and advisement of Shapley, were solidified by mid January of 1947. The

---

[61] After the Second World War, the US military began an energetic program to develop long-range rockets capable of delivering into and through the upper atmosphere, various military and scientific payloads. Although rockets could fly higher than either high-altitude balloons or aircraft, their flying time was limited and, as David DeVorkin points out, rockets were "far from a pristine environment for cosmic-ray research." Schein preferred the use of balloons "because they had longer flights, and maintained known altitudes in space." David Devorkin, *Science With a Vengeance: How the Military Created the US Space Sciences After World War II*, 247-248. The use of aircraft in cosmic ray research, in particular the high-flying B-29, had begun immediatly following the war. See ibid., 270-271, 255. Such programs were carried out by Bruno Rossi, who employeed B-29's at altitudes to 35,000 feet. See Bruno Rossi, Mathew Sand and Robert Sard, "Measurement of the Slow Meson Intensity at Several Altitudes," *The Physical Review* 72 (15 July 1947): 122. It stands to reason that Schein's concern for a pristine and controlled environment attracted him to the cosmic ray research possibilities on McKinley's upper regions. The use of Balloons in high altitude research, including celestial radiation is well documented. In addition to the McKinley expedition, Schein was involved in a number of high-altitude balloon programs related to upper-atmosphere radiation. For instance, Schein utilized the facilities and resources of Project Skyhook in the fall of 1947. The project was an ONR funded program utilizing high-altitude balloons which subsequently reached heights in excess of 31,000 feet; David DeVorkin, *Race to the Stratosphere: Manned Scientific Ballooning in America*, 296.

scientific program required a large research hut to be erected at 18,000 feet (as Washburn had envisioned) to house a system of telescopes (weighing 300 pounds), high voltage batteries, photographic recorders, heaters, an ionization chamber and spare parts. "Because the major scientific goal of the expedition was Cosmic Ray research in Denali Pass," Washburn later wrote, "the Army Air Forces agreed to furnish air support, in order to effect the establishment of this special camp."[62]

Washburn soon secured several additional scientific components for the expedition, including a collection of geological samples from the "tops of both peaks of McKinley in order to tie into work already done in the adjacent lowlands by the U.S. Geological Survey." He also developed

---

[62] Marcel Schein to Bradford Washburn, 12 January 1947, OWTF; Marcel Schein to Bradford Washburn, 24 January 1947. ibid. The importance of Air Force participation can be underscored by considering the following: A 9x9x6 foot cosmic ray hut was built in Anchorage, Alaska and eventually air dropped to the expedition at an altitude of 18,000 feet. Bradford Washburn to Marcel Schein, 18 March 1947, ibid; Bradford Washburn, "Operation White Tower," 2. The expedition was to utilize and test new Army Air Force cold weather clothing, a subject Washburn was intimately familiar with (discussed in chapter 3). A report outlining the effectiveness of such clothing was submitted by Washburn at the close of the expedition. See Bradford Washburn to Commanding General, Army Air Forces, 22 August 1947, OWTF, file 6.

plans for the collection of climatological data with instruments furnished by the U.S. Weather Service and cold climate field tests, to be carried out by representatives of the Army Air and Ground forces "of various articles of new equipment and food throughout the expedition."[63] Meanwhile, Paul Hollister was busy greasing the political wheels far in advance of the party's arrival in Alaska. He sought the support of his long-time friend and Alaska territorial governor, Ernest Gruening. In a letter to Gruening, Hollister contended that the publicity will "not be aimed at a few thousand, but as many as millions of readers and listeners" who will be interested in the "much sensational scientific material to be collected." Such a program, Hollister believed, would "also help your territory" and this is why "I know darn well you... will probably want to aid and abet it." Although he underscored the expedition's "scientific objectives," the Hollywood slant he had planned was to "include in the party 'for the first time on any stage' a photogenic woman - who is Mrs. Washburn herself."[64]

---

[63] "Army Ground Forces Representative Joins Mt. McKinley Expedition," press release, War Department, Public Relations Division, 19, March 1947, BWPP; Bradford Washburn, "Operation White Tower," 2.

[64] Paul Hollister to Ernest Gruening, 23 November 1946, OWTF, file 1. Although preliminary plans had called for the inclusion on the expedition of an actress, it was decided that Mrs. Washburn, who had previous Alaskan mountaineering experience, would be included.

To gain maximum publicity for the climb, the joint expedition between RKO Pictures and Washburn's New England Museum of Natural History was named Operation White Tower - a spin on Ullman's book *The White Tower.*[65]

Hollister later wrote Gruening again, noting that "as an old and expert publicist yourself, you will see that this has powerful and favorable publicity possibilities for the territory." Hollister explained that he wanted Gruening to "put the scheme in the top of your head along with 4 or 5 Martinis, let it slosh around and ferment there a while."[66] Although it is not clear whether or not Gruening followed Hollister's direction, he supported the plan and asked to be "informed just when the expedition is going to start so that I can make sure that it is properly welcomed."[67]

OPERATION WHITE TOWER

Brad and Barbara Washburn reached Anchorage, Alaska on 27 March 1947, where the task of sorting and organizing the

---

[65] Bradford Washburn, "Operation White Tower," 1.
[66] Paul Hollister to Ernest Gruening, 27 November 1946, ibid.
[67] Ernest Gruening to Bradford Washburn, 28 February 1947, ibid.

mountain of equipment kept the team busy for several days.[68] A few days later, Washburn made the first of several photographic reconnaissance flights above the mountain to an elevation of 23,500 feet to evaluate a safe climbing route.[69] Beginning in late March, team members were transported via ski-equipped aircraft to the Muldrow Glacier from Anchorage by Alaskan bush pilot Hakon Christenson, with the final flight made on 9 April.[70]

---

[68] Bradford Washburn, "Mount McKinley January 19 - July 10, 1947 ('Operation White Tower')" TD, Bradford Washburn Collection, 14, Box 2, file 1. (hereafter referred to as OWT). Croil Hunter, President of Northwest Airlines, supplied free transport for expeditions members and nearly 4,000 pounds of equipment from Minneapolis to Anchorage. Ibid., 2.

[69] Air logistical support throughout the expedition was carried out by the Alaska Air Command stationed at Fort Richardson, Anchorage. Bradford Washburn, OWT, 17.

[70] Two members of the expedition, George Browne and Bob Lange, arrived in Anchorage in advance of the rest of the party, and, on 17 March, began to transport equipment to the team's base camp at McGonagall Pass. Ibid., 11, 21. Team members included Bradford and Barbara Washburn, Grant Pearson (Chief Ranger, McKinley Park), Sergeant James Gale (10th Rescue Squadron), George Browne (son of pioneer Alaskan mountaineer and artist Belmore Browne), Lieutenant William Hackett (Army observer), Robert Lange, Hugo Victtoreen (directing the expedition's cosmic ray research program), Earl Norris (Dog Driver), William Deeke and George Wellstead (RKO movie photographers), Hakon Christenson (ski-plane pilot), "Red" Solberg (radio operator at Camp Eielson), Len Shannon (RKO PR man - who quit the expedition on 28 April) and William Sterling (Shannon's replacement). Ibid., ii.

Throughout the months of April and May, the team slowly and methodically moved up the mountain. Tedious survey work, the staging of film work for RKO, prolonged periods of bad weather, the collection of geological samples and the sheer task of the transport of equipment and food forced the expedition's slow, careful and purposeful pace. In late May, a vicious blizzard forced the team, now camped at several locations along the mountain, to spend several days sheltered in igloos. According to Washburn, the wind was "screaming" and "one of my crampons actually blew off my ice axe and fetched up on top of the igloo."[71] The weather had indeed played havoc with Washburn's plans, and he privately admitted that "our progress in the last month has been pretty sad in many ways." Much to Paul Hollister's liking, news stories, dispatched by the expedition, kept the public informed of its progress. However, not all of the public relations was positive. The climb was portrayed in the Anchorage press as melodramatic, with a less than sporting atmosphere due to AAF support which "prepares the way and tenderly watches over each rod of the distance traveled." The expedition was also denounced as a "pampered holiday of the self publicized Bradford Washburn party."[72] Although the work of RKO cameraman Bill Deeke was applauded with the

[71] Bradford Washburn, OWT, 57.
[72] "Good Camping Trip, Courtesy of the Army," *Anchorage Hi-Life*, 16 April 1947, 1-2..

release of a short documentary account of the climb the following year (1948), one Fairbanks newsman found the narrative to be "written with a pen dipped alternately in syrup and scented ice by a frail young man who had just rolled in crushed rose petals."[73]

On 25 May, due to the slow progress of the expedition, Washburn questioned the feasibility of carrying out Schein's cosmic ray work. Washburn confessed that "today for the first time we are beginning to wonder whether we can actually succeed in pulling off Vic's {Hugo Victoreen} scheduled cosmic ray program at 18,000."[74] The blizzard that besieged the party in late May not only delayed his schedule, but fully jeopardized the entire cosmic program. "Vic's Geiger counters are all destroyed (by the last storm)," Washburn wrote, "and we have wired Schein... for replacements."[75] However, Victoreen indicated to Washburn "that it would be virtually impossible to replace the lost counters in less that a month" and Washburn canceled the program on 27 May.[76] He explained his reasons for doing so in a telegram to Paul Hollister at RKO's New York Office:

---

[73] "McKinley Climb Filmed By Rugged Movie Cameraman," *Fairbanks Daily News-Miner*, 4 June 1948, p.1.
[74] Ibid., 60.
[75] Ibid., 61.
[76] Bradford Washburn, "Operation White Tower," 9.

> We have appraised the cosmic ray program thoroughly and have decided it cannot be continued... at this great altitude for sufficient time to make experiments worthwhile even if lost equipment could be replaced... Please explain unfortunate but unavoidable situation to Schein.[77]

On 4 June, just one week after Washburn canceled the cosmic ray program, he received a "Bombshell" of a telegram from Schein, via radio from Anchorage, indicating the importance he placed on the McKinley work:

> Counters replaced. Counters have already been sent to Anchorage via N.W. Airlines, carrying instructions that they be dropped with other cosmic ray 18,000 equipment... It would be highly profitable to undertake even part if not all of cosmic ray program without endangering life or health of personal.[78]

"Vic is pleased as punch," Washburn noted and he confessed, "so am I - - I hate to admit I'm licked and somehow or other we'll do this {carry out the cosmic ray work}."[79] With

---

[77] Bradford Washburn, OWT, 62.
[78] Ibid., 74.
[79] Ibid.

Schein's scientific program back on track, the expedition made its way to the summit of Mount McKinley on 6 June. With backpacks loaded down with food, survey and camera equipment, the team left the 18,000 foot camp at 10:30 am, and arrived at the south summit of McKinley in mid afternoon. Along the way, Bill Deeke, RKO cameraman, and Washburn, obtained film footage of the ascent.[80]

When Washburn reached the summit, Hackett and Lange had erected the survey tripod and theodolite. As Washburn later wrote, he started at once to obtain "3 key angles desired by the Coast and Geodetic Survey" with particular attention given to "accurate readings on the North Peak and Mt. Silverthrone," which were critical in providing ground control for future mapping programs of the either the mountain or its surrounding region. This work marked the first such survey to be carried out on the high slopes and summit of Mount McKinley.[81] As Washburn struggled in frigid winds to work the delicate theodolite, Deeke managed to film the summit team and the grandeur of the McKinley region from the top of the continent. Upon the completion of the survey and photographic work, the team began their descent on which

[80] Bradford Washburn, OWT, 75.
[81] Ibid., 76

Washburn obtained rock samples from just below the south peak.

A melancholy Washburn later noted: "At 5:30 after a good handshake all around we left the top.... I guess for the last time in my life -- it was for me at least a dramatic moment as we left: one of sadness, happiness and triumph mixed together." As Washburn later that evening wrote, the team celebrated their accomplishment with a "nightcap of the tiny bottle of whiskey given us by the Baptists the night we left" Anchorage.[82] The expedition scaled the mountain's north peak the following day (7 June, Washburn's thirty-seventh birthday) and carried out a three-hour survey program from the summit. The expedition had indeed succeeded in a number of areas. Washburn effected an impressive survey program and became the first person to scale the mountain twice. Moreover, Barbara became the first woman to climb the mountain, RKO obtained the precious footage they had sought and the pending cosmic ray work looked encouraging.[83] However, some individuals at RKO were disappointed in Washburn's refusal to participate, in an additional public relations request, just prior to the first summit attempt. As Washburn later wrote:

---

[82] Bradford Washburn, OWT, 76

[83] Ibid..

> RKO radioed us an impassioned plea to have us receive, by parachute, a full-scale, colored, plastic model of Rita Hayworth dressed in a very scanty bathing suit. We were to carry her to the top and photograph her there with Barbara and our team. My answer --- to our regret as well as theirs, was a firm no! A month later, at the end of the expedition we discovered Rita, leaning sadly in a corner of the 10th Air Force Rescue Squadron's supply room in Anchorage![84]

Soon after, the cosmic ray hut, its components comprising eleven separate parts and weighing about 800 pounds, was air dropped to the high camp. Victoreen erected the research hut and was ready to begin the cosmic ray work by 10 June. However, delays in shipping and poor flying conditions around the mountain delayed the delivery of the critical Geiger counters until 16 June. By this time, all but Victoreen, Gale and Lange (who would carry out the cosmic ray program) began their descent of the mountain and reached McGonagall Pass just as the scientific equipment was delivered along the mountain's upper slopes. Victoreen began his program on 17 June and it lasted ten consecutive days.[85] In the meantime, now located in the lowlands beneath the

---

[84] Bradford Washburn, "Mapping Mount McKinley," 10.

[85] Bradford Washburn, OWT, 78-83; "Operation White Tower," 14.

peak, Washburn began a survey of the mountain's surrounding region between the Eielson area and Wonder Lake. The data he collected would later be incorporated in a program to create a detailed map of the mountain. In addition, the information would also be used as a "basis for contouring the new map of the this areas now being prepared in Washington."[86] On 10 July, Victoreen, Gale and Lange joined the others at Wonder Lake, bringing Operation White Tower to an end after 92 days on the mountain.

The expedition had completed each facet of their scientific and photographic objects. Victoreen's cosmic ray data was hailed by physicists Thomas Carr, Schein and Ian Barbour (co-authors of the scientific analysis of the McKinley cosmic ray work), who later wrote that such work was previously "attainable only in short-duration plane flights." The information was incorporated into Schein's considerable data base of cosmic ray reading and compared to similar work performed on Mt. Evans (14,250 feet) in Colorado. Although the McKinley data indicated a negligible latitude effect, it "strongly indicates," the researchers found, "that an additional production of mesotrons," of rather low energy "takes place in the atmosphere between

[86] Bradford Washburn, "Operation White Tower," 14.

these two altitudes {those obtained on Mount Evans at 14,250 and 18,000 feet on Mount McKinley}."[87]

MAPPING THE MOUNTAIN LANDSCAPE

Washburn's interest and passion for mapping McKinley can be traced to several specific events. In 1936, Washburn led a jointly sponsored *National Geographic Society* and Harvard's Institute of Geographic Exploration aerial photographic reconnaissance of Mount McKinley. On 12 July, and then again on 16 July, expedition members boarded a Lockhead Electra monoplane in Fairbanks, piloted by S.E. Robbins, and flew around and just below McKinley's summit at an altitude of 20,000 feet. Clothed in oxygen masks, mittens and cold weather flying suits, Washburn, radioman Robert Gleason and data recorder Albert Linc Washburn (no relation), explored the ice-encrusted upper slopes of the mountain in detail.[88] Washburn choreographed the photographic work by directing

---

[87] Thomas Carr, Marcel Schein and Ian Barbour, "Cosmic-Ray Investigation on Mt. McKinley," 1419, 1423. Large-scale investigations continue today into the composition and characteristics of cosmic ray particles. For a an overview of ongoing cosmic ray research, see Thomas Cronin, Thomas Gaisser and Simon Swordy, "Cosmic Rays at the Energy Frontier," *Scientific American* (January 1997): 44-49.

[88] Bradford Washburn, "National Geographic - Mt. McKinley Flights: 1936," D, BWPP, 12. Linc Washburn was a member of Washburn's Mount Crillon Expedition's.

Robbins through McKinley's maze of rock and ice. "Gleason had prepared for me a telephone mouthpiece connected to a set of headphones on Robbins," Washburn later wrote. This enabled Washburn to "co-ordinate perfectly in getting the ship into the correct position for each photograph."[89]

The plane's cabin door had been removed so that Washburn could take oblique photographs of the peak. Using an old gas can placed in the open doorway as a chair, Washburn knotted a rope around his waist and tied the other end to the opposite side of the aircraft. This, he recalled, "let me lean just far enough out the opening to take pictures - and no further."[90] From this precarious vantage point, Washburn photographed the peak from numerous angles and confirmed the location of Mount Hunter, whose existence was yet to be substantiated.[91] As a result of these flights, Washburn

---

[89] Bradford Washburn, "Over the Top of the Continent," 97.
[90] Ibid. For a discussion regarding the existence of Mount Hunter, see Francis Farquhar, "Naming Alaska's Mountains," 222-224.
[91] Bradford Washburn to Gilbert Grosvenor, Gilbert Grosvenor file 11-15.759 - Washburn, Bradford, 1937 McKinley, 13 July 1936. Washburn used a Fairchild K-6 Aerial Camera, which was given to Harvard's Institute for Geographic Exploration by Captain Albert Stevens. Washburn later described the K-6 as an "archaic... hideous, obsolete, bulky, heavy old thing which is absolutely perfect for the use to which I put it." See Bradford Washburn, "Aerial Photography: Alaska and the Alps," in Malcolm Barnes, ed., *The Mountain World* (Chicago: Rand McNally & Company, 1961), 20. For a brief but

explains, he became "more and more fascinated by the magnificent wilderness of the McKinley massif." His enthusiasm and "interest in its peaks and glaciers was so whetted that I returned in both 1937 and 1938," to make additional photographic investigations.[92] During his subsequent work above the peak in the summer of 1937, Washburn reported to the *National Geographic Society*, that he obtained a "good many photographs" of the mountain's southern flanks and several taken "from an altitude almost 2,000 feet above the summit... which also were notably lacking from our last summer's series."[93] In 1938, Washburn

---

informative history of the Fairchild Camera Company, see Anthony Brandt, "Sherman Fairchild Looks at the World: How a Millionaire Inventor Got the Bugs Out of Shutters and Made Accurate Aerial Photography Possible," *Air & Space*, (October/November 1990), 96-99. Stevens had used the camera on a number of high altitude aerial explorations. See, for instance, the following articles by Albert Stevens, "Exploring the Valley of the Amazon in a Hydroplane," *National Geographic Magazine*, April 1926, 401; "Flying the Hump of the Andes," *National Geographic Magazine*, May 1931, 595-636. See also Walter Clark, *Photography by Infra Red* (John Wiley Co.: New York, 1939), 269. In 1933, Stevens took the fartherst photograph of earth thus far attained. Stevens was one of the first to pioneer the use of infra red photography, a technique Washburn used to photograph McKinley during his 1936 flights. See Bradford Washburn, "National Geographic Flights - Mt. McKinley Flights: 1936, 13.

[92] Bradford Washburn, "A New Map of Mount McKinley, Alaska: The Life of a Cartographic Project," 160.

[93] Bradford Washburn to Gilbert Grosvenor, Gilbert Grosvenor file 11-15.759 - Washburn, Bradford - 1937 McKinley, 1 October 1937.

photographed McKinley once again, as well as other areas throughout the Alaska Range and the mountains of the St. Elias Range.

This wealth of photographic information constituted the foundation from which Washburn would extend his exploration of the McKinley region and provide critical data to direct his subsequent ground and aerial surveys of the mountain. As previously discussed, Washburn did not set foot on the mountain until 1942, when he served as a cold weather consultant to the US military's Mount McKinley Expedition. He had noted at the time that the entire program was "handicapped from start to finish by lack of a good map." On a subsequent military field test in 1945 to the McKinley region, the need for a reliable map of the area became even more apparent. Therefore, he initiated a preliminary survey of the mountain and its surrounding landscape. Washburn later wrote that this experience "got me gently started on the project."[94] The means by which Washburn would be able to create his map materialized as a result of his uncanny ability to link large-scale expeditionary science with private, corporate and government patrons.

---

[94] Bradford Washburn, "A New Map of Mount McKinley, Alaska: The Life Story of a Cartographic Project," 160.

When Operation White Tower came to a close in the summer of 1947, Washburn possessed critical survey data of McKinley's surrounding lowlands and upper slopes. As part of the expedition's plan, this data was enhanced and complimented by a series of vertical mapping photographs of the mountain, which were taken from an altitude of 40,000 feet from an AAF B-47 aircraft. From 1949-1952, the USGS incorporated these photographs and Washburn's 1947 survey data into their expanded McKinley mapping program, from which they produced a new map of *Mount McKinley National Park* and topographic data sheets of mountain. Although this information constituted the first comprehensive view of the peak, according to Washburn, the USGS "did not expect to push survey work into the high mountains for some time."[95] This offered Washburn a unique opportunity to carry out such a program, which he did so throughout the next decade.

Washburn later described the process of mapping the mountain in this fashion: "I wish I could say that this map is the result of an orderly, long-range plan, slowly and carefully brought to fruition. Unfortunately it is not." From 1949-1959, Washburn was involved or directed seven survey expeditions either to or over the McKinley landscape. During

[95] "Mount McKinley National Park," 1:250,000 (Washington, D.C.: Government Printing Office, 1952.); Ibid., 164.

this period, he established survey observation stations throughout the area, choreographed a number of B-29 and B-47 high-altitude photographic flights (1951, 1955) and utilized helicopters to transport numerous survey teams into the heart of the McKinley massif.[96] As part of this unique program, Washburn led a nine man expedition to climb McKinley's West Buttress, a route he had discovered and proposed several years before.[97] The expedition had a number of scientific and practical purposes, which included an extension of Washburn's survey work and the acquisition of geological samples for the University of Denver. Washburn also hoped that the route would provide a safer and more practical route to the mountain's upper slopes for the purpose of "research at high altitudes."[98]

---

[96] Bradford Washburn, "A New Map of Mount McKinley: The Life Story of a Cartographic Project," 164-179. "Elevation of Mt. McKinley," *The Military Engineer* (September-October 1956): 384; Bradford Washburn " Mapping Mount McKinley," 12; Bradford Washburn, "Reconnaissance of Mt. McKinley: July 26-August 30," D, Bradford Washburn Collection, 92-147, box 3; Bradford Washburn, "Alaska Field Observation - 1952," ibid.; Bradford Washburn, "Mt. McKinley Field Observation: 1953," ibid,; Bradford Washburn, "Field Observations: 1959," Ibid; Neil Gahagan, "The Mountain Tamer," *The Bee-Hive*, January 1950, 18-20.

[97] Bradford Washburn, "Mount McKinley From the North and West," *American Alpine Journal* (1947): 283-93. Washburn had discovered this route, accessible along the Kahiltna Glacier, during his numerous reconnaissance flights and having twice scaled the peak from the north.

[98] Bradford Washburn, "Mount McKinely: The West Buttress, 1951," *American Alpine Journal* (1952): 214-215; William

Washburn's route, scouted entirely from the air because no one had set foot on that side of mountain, required the transport of men and supplies via a ski-equipped "Super Cub 125" aircraft from Chilatna Lake to the Kahiltna Glacier at an altitude of 10,000 feet. Dr. Terris Moore, then president of the University of Alaska, successfully piloted numerous trips to the glacier and supplied the team periodically with mail and fresh food.[99] As on past Washburn-McKinley expeditions, AAF aircraft supplied aerial support, dropping additional tons of food and equipment to the men. The members of the expedition, which began on 18 June, climbed

---

Hackett, "Report on 1951 MOUNT MCKINLEY EXPEDITION: sponsored by Boston Museum of Science, University of Denver, University of Alaska," 2, 31 October 1951, BWPP. Washburn's reference to high altitude research is in reference to the possible establishment, supported by Marcel Schein, of a cosmic ray observatory on McKinley. According to Washburn, Schein canceled the idea due to advancements in particle accelerators which afforded a controlled and more economic means of investigating atomic structures and radiation. Bradford Washburn to Mike Sfraga, telephone conversation, 5 December 1996. Moreover, the implementation of improved vehicles such as high altitude aircraft, balloons and rockets made the project less attractive. See, for instance, David DeVorkin, *Science With A Vengeance: How the Military Created the US Space Sciences After World War II,*" 265. For a discussion of the development of such accelerators, see, for instance, Daniel Kevles, *The Physicists: The History of a Scientific Community in Modern America*, 270-271.

[99] Bradford Washburn, "Mount McKinley: The West Buttress: 1951," 215.

and mapped their way for nearly a month to the summit, which they reached 10 July. By reaching the top, Washburn became the first person to do so three times, and the summit had proven to be as quick and safe as Washburn had predicted.[100] The survey data obtained on the expedition was added to that of Washburn's previous expeditions, as well as was the information obtained from the USGS and the US Coast and Geodetic Survey. Washburn's West Buttress route is now the standard route by which over 70 percent of all McKinley climbers attempt the peak each year. Ski-plane transport from Talkeetna, just south of the mountain, to the Kahiltna Glacier has spurred a thriving industry of pioneer bush pilots in this small Alaskan community.

By the late 1950's, Washburn had obtained sufficient data to begin preliminary work on the map. Compilation of the McKinley survey data began in Switzerland in the summer of 1958. As Swiss cartographers are known the world over for their accurate and aesthetically striking map production, Washburn utilized the vast talents and resources of some of that nation's top cartographers and artists. Financial and logistical support for the project was supplied by the Swiss Institute for Alpine Research, and cartographic artwork and eventual printing was afforded through the Swiss Federal

[100] Ibid., 223.

Institute of Topography.[101] Published in 1960, the map is a brilliant mixture of artistic topographic relief and cartographic accuracy. Washburn's ability to organize and lead such an undertaking is underscored by the sheer magnitude of the project. Over the course of fifteen years, funding had been secured from a number of disparate individuals, organizations and institutions including the US military, Boston's Museum of Science, the US Coast and Geodetic Survey, the USGS, the *National Geographic Society*, Harvard's Institute for Geographical Exploration and the American Academy of Arts and Sciences (the latter providing significant financial resources for the actual publication of the map). Individual funding for the project came from many of Washburn's public lectures as well as the generous financial support of his long-time mentors, Dr. Hamilton Rice and Captain Albert Stevens.[102]

The map's scale is an impressive 1:10,000 with 5-meter contour bands, which details the McKinley massif as no other had done prior to its production.[103] Washburn advanced

---

101 Bradford Washburn, Hugo Kasper and Ernst Huber, *Mount McKinley, Alaska: A Reconnaissance Topographic Map by Bradford Washburn*, (Waben: Neue Zurcher Zeitung, 1960), 5
102 Ibid., 3-6.
103 Bradford Washburn, "A Map of Mount McKinley Alaska," *Museum of Science* (Waben: Swiss Federal Institute of Topography, 1960).

understanding of the peak in two dramatic and practical ways. The artistic detail allowed both mountaineers and scientists to evaluate and execute climbing and research endeavors on the mountain. Moreover, it provided a tangible means by which one could appreciate and experience the mountain world without ever stepping foot in Alaska. Indeed, the map is not just appealing to the McKinley mountaineer, but also to those who enjoy the lure and sheer magnitude of the mountain landscape.

MR. MCKINLEY

For nearly a quarter of a century (1936-1960), Washburn photographed, climbed and surveyed in and around the McKinley massif, bridging generations of early McKinley pioneers who explored the region at the turn of the century. It would be neither fair nor appropriate to compare Washburn's work to that of turn-of-the-century explorer-cartographers such as Dickey, Muldrow, Reaburn or Porter. Yet, it is in such context that one can appreciate both Washburn's contributions and the early work of these hearty and dedicated men of science and exploration. Indeed, in 1955, the accepted altitude of McKinley's taller southern peak, calculated by the USGS and US Coast and Geodetic Survey, with the assistance of Washburn's data, was established at 20,320 feet.[104] This figure, obtained with the most modern equipment of that time, aerial photography and logistical support, is strikingly close to the 1896 estimate made by Dickey of 20,000 feet, Muldrow's 1898 observation of 20,464 feet, and Reaburn's 1902 determination of 20,155 feet.

Washburn's fascination with measuring Mount McKinley did not end with the public release of the map in August 1960. In September of that year, Washburn convinced General Nathan Twining to utilized a product of Cold War technology to once again photograph the peak. The U-2 photoreconnasaince aircraft had been developed primarily to obtain accurate, and thus strategic, high altitude information over broad geographic areas. On 6 September 1960, just four months after a U-2 aircraft, piloted by Gary Powers was shot down over the Soviet Union, the Air Force carried out, a run of U-2 pictures from an altitude of 68,000 feet over Mt. McKinley.[105]

---

104 "Elevation of Mt. McKinley," 384.

105 Bradford Washburn, "Mapping Mount McKinley," 12. This roll of nine and one-half inch negatives have been deposited in the Bradford Washburn Collection at the University of Alaska Fairbanks, 91-024, box 3, file 6. For an insightful discusion and analysis into the development and employment of Cold War reconnaissance satellites and aircraft, see John Lewis Gaddis, *The Long Peace: Inquiries Into the History of*

Washburn's encyclopedic knowledge of and experiences in McKinley's unique environment and geography became sought after by scores of mountaineers the world over. One reason is that Washburn was generous with his data bank of Mckinley knowledge. From the late 1940's, he periodically tempted mountaineers by proposing numerous mountaineering challenges and routes which were inevitably attempted following their publication. He carefully crafted detailed route-lines on a myriad of vivid black and white oblique photographs of McKinley and, by doing so, outlined increasingly difficult and interesting potential ascents of the peak.

For instance, in 1957, he proposed a summit route up McKinley's steep and exposed South Face.[106] In 1961, guided by Washburn's photos and extended correspondence, Riccardo Cassin, one of Italy's most distinguished mountaineers, led a successful ascent of this route, now known to mountaineers as "The Cassin."[107] Two years later, Washburn recruited a

---

the Cold War (New York: Oxford University Press, 1987), 195-214.

106 Bradford Washburn, "Mount McKinley (Alaska): History and Evaluation," in Malcolm Barnes, ed., *The Mountain World* (New York: Harper & Brothers, 1957), 80-81.

107 Riccardo Cassin, "The South Face of Mount McKinley," *American Alpine Journal* (1962): 27-37. For additional insight into the life and mountaineering achievements of one

group of young, yet able, Harvard College mountaineers to attempt a direct northern route up McKinley's northern avalanche-strewn slopes. As David Roberts, a member of that group, later wrote, Washburn "urged on us a 'line' he had scouted from the air that went straight up the east-central section of McKinley's 14,000-foot Wickersham Wall."[108] Later that summer, this group of seven students climbed the very route he had forced upon them. In doing so, this willing band of mountaineers climbed their way into McKinley history - making the first ascent of the wall named in honor of the Fairbanks judge, who six decades before, had been the first to challenge North America's tallest peak.

Washburn's accomplishment on and knowledge of McKinley made his name synonymous with the mountain. He embraced and utilized the realities of Cold War funding organizations and scientific partnerships and employeed the most advanced technologies and vehicles to carry out expeditionary science on North America's highest mountain. His black and white

---

of the world's celebrated mountaineers, see Riccardo Cassin, *Fifty Years of Alpinism* (Seattle: The Mountaineers, 1982).
[108] David Roberts, "The Legacy of Washburn," in *Mount McKinley: The Conquest of Denali*, 134.

photographs of the peak remain sought after by thousands of mountaineers, scientists and photographers throughout the world. He has indeed become "Mr. McKinley."

CHAPTER 5

EPILOGUE AND CONCLUSION

FROM SLEDGE TO SHUTTLE

Washburn's career as expeditionary scientist, map maker and photographer did not end in the 1960's. During the next three decades, he directed several cartographic projects from the rugged Southwestern United States to the massive Himalayan Plateau of Nepal and China. In 1971, he began a seven-year surveying project for the *National Geographic Society* to map the Grand Canyon. In five field seasons (1971-1975) Washburn and his wife Barbara were transported by helicopter to over six hundred remote sites where he used laser survey equipment to carry out the survey work. The map was published in 1978 and distributed in the July issue of the *National Geographic Magazine*.[1]

---

[1] Bradford Washburn, "The Heart of the Grand Canyon," *National Geographic Magazine*, (July 1978). The map was co-produced by the *National Geographic Society* and Boston's Museum of Science. For a summary of Washburn's mapping

In 1977, he obtained a more accurate geographic position of Mount McKinley by making the first Laser measurements of the peak. This information was critical as previous mapping of the mountain had been based on the readings from various survey stations in relation to the mountain's geographic location. Washburn's work revealed that the observations which were gathered nearly twenty five years earlier were accurate to within 18.37 feet.[2] Even today (1997), Washburn continues to fine-tune his McKinley measurements by assisting young surveyors in recalculating McKinley altitude through the application of GPS.[3]

Washburn retired as director of Boston's Museum of Science in 1980. Yet the next year he initiated negotiations with the Chinese and Nepalese governments to re-survey Mount Everest, the tallest mountain on Earth. This work involved scientists, cartographers and mathematicians from ten nations and was funded, in part, by *the National Geographic Society*.

---

program, see page 37. See also W. E. Garrett, "Grand Canyon: Are We Loving it to Death?," Ibid., 16-51.

[2] Bradford Washburn, "The First Laser Measurements to the Summit of Mount McKinley," *American Alpine Journal* (1978): 382; Bradford Washburn, "Alaska 1977 Laser Angles," D, Bradford Washburn Collection, 90-146, box 1, envelope 4.

[3] Bradford Washburn to Editor, Earth Magazine, 29 March 1994. BWPP.

In addition to ground-based surveys, which began in 1992, Washburn added a new element to his survey instrumentation - the US Space Shuttle Columbia, which authors Ron Graham and Roger Read have described as the "ultimate survey platform."[4] In December, 1993, Columbia astronauts took a series of overlapping infra-red photographs of Mount Everest. This stereophotography was done at an altitude of 156 miles above the earth and covered an area of more than thirteen thousand square miles. To these photographs was added a series of high altitude images taken from a Learjet at 40,000 feet. Once again, Washburn, geographer and entrepreneur, incorporated into his work the most advanced technologies and brightest scientific minds to produce, in 1988, the most accurate map of Everest to date.[5]

Washburn's methods for exploring Mount Everest illustrated motifs common throughout his career. As we saw in Chapter 1, this great peak first came to intrigue Washburn as a

---

[4] Ron Graham and Roger Read, *Manual of Aerial Photography*, 298.

[5] Bradford Washburn, "Mapping Mount Everest," speech presented at the University of Alaska Fairbanks, May 1990, Fairbanks, Alaska, 2-33. BWPP. Bradford Washburn, "Mount Everest: Surveying the Third Pole," *National Geographic Magazine*, November 1988, 653-659. For an artistic representation of the role of the Space Shuttle Columbia, see 655.

teenager, when he listened to a moving lecture by Everest veteran Captain John Noel. His fascination continues to this day; as I write this in April 1997, Washburn is directing a number of Everest mountaineering and scientific teams engaged in obtaining a more accurate altitude and position of the mountain through the use of GPS technology.[6] At nearly 87 years of age, Washburn no longer scales the great peaks of the world. Rather, he continues to organize these research programs from his Boston office, directing various geographic expeditions in remote corners of the world. In a 1996 letter to David Rawle, a fellow Groton School classmate, Washburn explains his motivation and purpose in such endeavors:

> As we get older and do more thinking abut what we DID instead of what we're <u>going to do</u>. I find that it's been wonderful to try to identify <u>what I would like to do today IF I was still 35 or 40, but with all the exciting machinery of today in hand</u>----Satellites, laser, radio and new geologic techniques. Then I try to find some fellows <u>who are 35-40</u> who'd like to do what I WISH I COULD DO - and help them get the money to do it and give them the battle-plan... If they succeed, I get almost as much of a thrill out of their success as I would if I had done it with them.[7]

[6] Bradford Washburn, "The Altitude and Position of Mount Everest," unpublished report, 1-12. BWPP.
[7] Bradford Washburn to David Rawle, 31 January 1996. BWPP.

This practice of Washburn's had its roots in late nineteenth century American science and exploration. The exploration of North America by Lewis and Clark (1803-1806) was made possible by the vision, ambition and patronage of President Jefferson, who may have attempted such a journey had not his age and demands of the Presidency preclude such an undertaking.[8] Just as Hamilton Rice and Captain Stevens had enabled a number of Washburn's remote expeditions, Washburn now makes possible similar opportunities for a new generation of field scientists. He is one of the last such explorers who, like his mentors, enables exploration through an extensive network of personal contacts. This style of exploration worked especially well prior to World War II. And although Washburn utilized such funding in the post war era, he continued to rely on personal networks to augment his work - a style which is now impossible, given the vast expansion of scale and stratification of the natural sciences and social sciences. Indeed, the work now being

[8] For a lively yet scholarly investigation of the Lewis and Clark expedition and the role of Thomas Jefferson it development, see for instance Stephen E. Ambrose, *Undaunted Courage: Meriweather Lewis, Thomas Jefferson and the Opening of the American West* (Simon and Schuster: New York, 1996).

carried out on Everest may not have materialized without this characteristic "Washburn style."[9]

The field of geography has long been challenged as a separate, viable and practical component of academic study and as a profession. One hears the quote: "Geography is what geographers do." To most this may seem a statement which lacks focus or substance. However, it is more accurate than one might suspect, as geography is an integrating discipline of practice and study. It transcends a multitude of academic and applied areas. Yet geography is not only central to our knowledge of the landscape, but it provides a forum and a vehicle for broad field studies and investigations. Geography integrates all that we have come to know of the landscape and gives to us a more complete understanding of

---

[9] For a discussion of scientific patronage in the mid twentieth century, see Harvey Sapolsky, "Academic Science and the Military: The Years Since the Second World War," and Robert Kohler, *Partners in Science: Foundations and Natural Scientists 1900-1945.* Although Washburn utilized military funding in the post war era, he retained strong ties with personal networks which he had developed prior to the war. These private and corporate patrons were an important component of his funding formula. He continues to utilize this style today, providing a means through which funding can be obtained for such geographic research as Mount Everest. "Washburn Photographs Illuminate Geologic Features," *GSA Today* 5, no. 10 (15 October 1995): 200-201.

the earth. "For many of us," Washburn wrote, "the only tie between us and science is this interest in geography."[10]

More than a century ago, James Bryce, the British ambassador, described geography as a "meeting point between the sciences of Nature and the sciences of man."[11] Washburn's explorations are a vivid example of Bryce's declaration. Geography, Washburn noted, provides a means to explore and understand the "complex relationships between man and materials and science."[12] To underscore this point, at a meeting of the *American Geographical Society*, Washburn noted:

> We realize that geography, the study of our earth, was, for almost all of us, the logical avenue into most of our other intellectual interests, whatever they may be. One rarely finds anthropologists or astronomers at the annual meeting of the chemical society --- or physicists and mathematicians at a paleontological discussion -- Yet tonight this

[10] Bradford Washburn, "'Geography --- Dynamic Catalyst for Science,'" printed address at the Annual Dinner of the American Geographical Society, New York, New York, 3 December 1964, 6. BWPP.
[11] James Bryce, "The Relations of History and Geography," *Contemporary Review* 49 (1886): 426.
[12] Bradford Washburn, "'Geography --- Dynamic Catalyst for Science,'" 6.

> room is filled with top experts from all of these fields and many others besides.[13]

Indeed, Washburn's words would have been welcome support to British geographer Halford Mackinder, an early (1887) outspoken champion of the integrating nature of geography. He believed an "abyss" existed between the "natural sciences and the study of humanity." Mackinder, David Livingstone noted, "allocate{d} geography the task of reintegrating society and environment."[14] Washburn has surely integrated the natural and social sciences through geographic exploration, spanning at least a portion of the "abyss" which today still remains.

Although the interdisciplinary nature of the field has made the discipline a target for academic purists, it has provided Washburn with a flexible and productive forum in which to explore and study.[15] Throughout Washburn's career,

---

[13] Ibid., 7. See also David Livingstone, *The Geographical Tradition: Episodes in the History of a Contest Enterprise*, 191-192.
[14] Halford J. Mackinder, "On the Scope and Methods of Geography," *Proceedings of the Royal Geographical Society* 9 (1887): 143, quoted in David Livingstone, *The Geographical Tradition: Episodes in the History of a Contested Enterprise*, 190. Livingstone's quote is found on the same page.
[15] Neil Smith, "'Academic War Over the Field of Geography': The Elimination of Geography at Harvard, 1947-1951," *Annals of the Association of American Geographers* 77, no. 2 (June

geography has been the catalyst for his photographic, cartographic and geologic explorations. From 1930 to 1960, Washburn incorporated such disparate individuals as glaciologists, cosmic ray physicists and cartographers to bring about a comprehensive study of the mountain landscape and environment. Although his most tangible and, perhaps, most recognized results of such work often were his photographs and maps, Washburn's expeditions made possible the collection of significant scientific and geographic information. Even today, in an age when almost all academic disciplines and professions have become increasingly stratified and specialized, Washburn is able to bring together experts from various fields to study a particular geographic region.[16] The Mount Everest work of the late 1980's and 1990's is one such example.

1987): 155-172; D.P. Putnam, "Geography is a Practical Subject," in Griffith Taylor, ed., *Geography in the Twentieth Century: A Study of Growth, Fields, Techniques, Aims and Trends* (New York: Philosophical library, 1951), 395.

[16] Historians and scholars have only recently begun to address the development of interdisciplinary fields; for an introduction, see Peter J. Bowler, *The Norton History of Environmental Sciences*, Ronald Doel, "The Earth Sciences and Geophysics," in John Krige and Dominique Pestre, eds., *Science in the Twentieth Century* and Stephen E. Toulmin, *Cosmopolis: The Hidden Agenda of Modernity* (New York: Free Press, 1990).

Washburn has been described in many ways: photographer, mountaineer, explorer, administrator, scientist and cartographer. Yet the persistent focus of his career has been geography. By examining his career, one gains insight into the role and practice of the independent geographer, generating his own funding from private, corporate and government patrons. Washburn supported his work by cultivating such patrons over a prolonged period of time. His relationship with the *National Geographic Society*, spanning nearly seven decades, has been most productive. The *Society* sponsored expeditions were lavishly published in the pages of their magazine, capitalizing on Washburn's dramatic photography and the lure of remote regions. The Office of Naval Research, Dr. Hamilton Rice of Harvard's Institute of Geographic Exploration, Northwest Airlines, RKO Pictures and the Penrose Foundation of the *Geological Society of America*, are but a few of the patrons who supported his work and made possible the production of numerous maps and thousands of aerial photographs.

In 1935, Washburn utilized dog teams and man-hauled sledges to traverse the uncharted mountain wilderness of the Wrangell- St. Elias region. In the six decades which followed, Washburn applied emerging technologies and modes of travel and supply to his geographic expeditions, from AAF aircraft, helicopters, U-2 spy planes, Learjets, lasers, GPS, to the Space Shuttle. This application of technology to expeditionary science has produced striking photographs and increasingly more accurate maps of the landscape. Washburn's emphasis on the use of new technologies underscores his commitment create the most accurate and vivid portrayal possible of the landscape.

This is a value inherent, I believe, in geography and geographic exploration. Washburn's insistence on accuracy goes beyond a broad concern for the product in which he delivered to patrons. Washburn demanded perfection of his work because such measures were a personal and professional value. In a 1993 interview, Washburn shared this philosophy:

> If you make a map topographically almost perfect in its detail, all of a sudden the whole map looks like reality. And the more beautiful and realistic a map is, the better it conveys its information. If you believe that one's appreciation of the natural world as a whole is greatly enhanced by intimate knowledge of detail, then beautiful, accurate maps make perfect sense... This sort of map is much more than a representation of geography or a tool to make hikers navigate -- it

> is a rendering of the fascinating undulations of the earth's surface.[17]

Washburn's expeditions of geographic discovery have been, in part, the product of a cunning entrepreneur, explorer, mountaineer, visionary and enabler. "My mother often worried that I would become a mountain guide," Washburn recalled, "so she was relieved when I started working at the museum."[18] Yet, in an interesting way, Washburn has become a guide for millions of people who have read his articles, absorbed his photographs or admired and used his maps. He has provided a means by which many non mountaineers may appreciate more the mountain world.

To be sure, Washburn joins an impressive community of geographic explorers and expeditionary scientists who, over the centuries, have pieced together the planet's mosaic of flora, fauna and landscape. Washburn has his own vision of and appreciation for his role in our understanding of the natural world. He often completes many of his public lectures with this quote from Aristotle:

---

[17] Bradford Washburn, interview with Tom Stepp, Holderness, New Hampshire, 1 July 1993. Transcribed tape recording, 1-2. BWPP.

[18] Bradford Washburn, interview with Mike Sfraga, tape recording, Boston, Massachusetts, 18 July 1992.

The Search for the Truth
Is in one way hard -- and another easy
For it is evident that no one of us can ever
Master it fully -- or miss it wholly
Each one of us adds a little
To our understanding of Nature
And, from all the facts assembled
Arises a certain grandeur

Indeed, he has added a great deal to our understanding of the earth's dynamic landscape. To the general public, Washburn's maps and photographs hold an aesthetic and, perhaps, scientific appeal. However, to those who look beyond the final tangible results of such work, the way in which Washburn organized and carried out his field work is most fascinating. It is here that a rich, yet neglected area of future study abounds.

For decades, the work done by field scientists and explorers was undervalued. The way in which such expeditionary science was organized, funded, and effected held little interest throughout larger academic communities. As a result, such scientists and geographers were afforded relatively low academic status. Although Washburn's work has been welcomed and appreciated by geographers, geologists and glaciologists, many expeditionary scientists and field geographers have not faired as well.[19] On this subject, historians of science Henrika Kuklick and Robert Kohler wrote the following: "Scholars derive their own status from that of their subjects... Defining scientific rigor by the standards of the laboratory, scholars have judged the field to be a site of compromised work."[20] By examining Washburn's geographic and scientific expeditions, one can better understand the importance of not only the technical results of this work, but of the very study of the ways in which expeditionary science was carried out in mid twentieth century America.

---

[19] E.D. Waddinton, "Wave Ogives." For a personal and professional tribute to the scientific and aethestic value of Washburn's photographs, see Austin Post, "Annual Aerial Photography of Glaciers in Northwest North America: How it all Began and its Golden Age." *Physical Geography* 16, no. 1 (January-February 1995):17.

[20] Henrika Kuklick and Robert Kohler, "Science in the Field, Introduction," *Osiris* 11, 1.

LITERATURE CITED

The following list of abbreviations has been developed for journals and magazines with multiple listings. The full citation is given first, followed thereafter by its abbreviated citation. Similar sources that are cited less frequently have been given full citation.

Abbreviations

AAJ	American Alpine Journal
AG	American Geologist
BAGS	Bulletin of the American Geological Society
BGSA	Bulletin of the Geological Society of America
BJHS	British Journal for the History of Science
GJ	Geographical Journal
GR	Geographical Review
HMM	Harpers Monthly Magazine
JG	Journal of Glaciology
NGM	National Geographic Magazine
NGSRR	National Geographic Society Research Reports
OM	Outing Magazine
PG	Physical Geography
PR	Physical Review
USGSB	United States Geological Survey Bulletin
USGSPP	US Geological Survey Professional Paper

"Alaskan Boundary." *Bulletin of the American Geographical Society 857* (June 1889).

Abramson, Howard. *National Geographic: Behind America's Lens on the World*. New York: Crown Publishers, 1987.

Ahlmann, Hans Wilson. "Forward." *Journal of Glaciology* 1 (1947).

Aikano, Olin. *The Winter War: Finland Against Russia, 1939-1949*. Trans. Vaino Alfred Tanner. Stanford: Stanford University Press, 1957.

Allen, Henry. *Report of an Expedition to the Copper, Tanana and Koyukuk Rivers, in the Territory of Alaska.* Washington, D.C.: Government Printing Office, 1887.

American Geologist. "Note on Mount Logan." *American Geologist* 13 (1894).

Amundsen, Roald. *The North West Passage: being the record of a voyage of exploration of the Ship Gjo 1903-1907.* London: Constable, 1908.

________. "To the North Magnetic Pole and Through the Northwest Passage." *Geographical Journal* 29.

________. *My Life as an Explorer.* New York: Doubleday, Page, 1927.

Amundsen, Roald, A.G. Chater, trans. *The South Pole.* London: John Murray, 1925.

Ariev, T.V. "Fundamental Outlines of Present Day Knowledge of Frostbite." Trans. and ed., Earl Hope, *Frostbite.* Ottawa: Earl R. Hope, 1950.

Bagley, James w. "The Use of the Panoramic Camera in Topographic Surveying." *USGSB* 657. Washington, D.C.: 1917.

Baxter, James Phinney. *Scientists Against Time.* Cambridge: The M.I.T. Press, 1952.

Beckwith, Edward. "The Mt. McKinley Cosmic Ray Expedition." *AAJ* (May 1932).

Berton, Pierre. *The Arctic Grail: The Quest for the North West Passage and the North Pole.* New York: Penquin Group, 1988.

Blake, William. "The Glaciers of Alaska, Russian American." *American Journal of Science* 2nd series, 44 (1867).

Boddington, Jennie. *Antarctic Photographs: Herbert Ponting and Frank Hurley*. New York: St. Martin's Press, 1979.

Botsford, A. "Catching Up With Bradford Washburn." *Appalachia* (January/February 1986).

Bowler, Peter. *The Norton History of The Environmental Sciences*. New York: W.W. Norton & Company, 1993.

Brandt, Anthony. "Sherman Fairchild Looks at the World: How a Millionaire Inventor Got the Bugs Out of Shutters and Made Accurate Aerial Photography Possible." *Air & Space* (October/November 1990)

Brockman, B and Hans Mothes. "Seismische Untersuchungen auf dem Pasterzengletscher 1, *ZG* 6 (1930).

Brooks, Alfred H. "A Reconnaissance in the Tanana and White River Basins, Alaska, in 1898." *USGS, 20th Annual Report, VIII: Explorations in Alaska in 1898*. Washington, D.C.: Government Printing Office, 1900.

________. *Preliminary Report on the Ketchikan Mining District, Alaska, with Introductory Sketch of the Geology of Southeastern Alaska*. Washington, D.C.: Government Printing Office, 1902.

________. "Mountain Exploration in Alaska." *Alpina Americana* 3.

________. "An Exploration to Mount McKinley, America's Highest Mountain." *Smithsonian Institution Annual Report 1903*. Washington, D.C.: Government Printing Office, 1904.

________. "The Mount McKinley Region, Alaska." *USGSPP* 70. Washington, D.C.: Government Printing Office, 1911.

Brooks, Alfred H. and D.L. Raeburn. "Plan for Climbing Mount McKinely." *NGM* (January 1903).

Brown, William. A *History of the Denali-Mount McKinley Region, Alaska*. Santa Fe: National Park Service, 1991.

Browne, Belmore. *The Conquest of Mount McKinley*. Boston: Houghton Mifflin Company, 1956.

Bryan, C.D.B. *The National Geographic Society: 100 years of Adventure and Discovery*. New York: Harry N. Abrams, 1987.

Bryce, James. "The Relationship of History and Geography." *Contemporary Review* 49 (1886).

Buwalda, John, in William Colby. *John Muir's Studies in the Sierra*. San Francisco: Sierra Club, 1960.

Byrd, Richard Evelyn. "The Conquest of Antarctica by Air." *NGM* (August 1930).

________. *Little America: Aerial Exploration in the Antarctic*. New York: G.P. Putnam's Sons, 1930.

Cairns, Ralph. "Hazards of Climbing Mount McKinley." *Overland Monthly* (February 1913).

Carr, Thomas, Marcel Schein and Ian Barbour. "Cosmic-Ray Investigations on Mt. McKinley." *PR* 73, no. 12 (15 June 1948).

Carter, Adams H. "Mountain Intelligence." *AAJ* (1946).

Cassin, Ricardo. *Fifty Years of Alpinism*. Seattle: The Mountaineers, 1982.

Castner, J.C. "A Story of Hardship and Suffering in Alaska." *Compilation of Narratives of Exploration in Alaska*. Washington, D.C.: Government Printing Office, 1900.

Center for Military History. *Effects of Climate on Combat in European Russia*. Washington, D.C.: Government Printing Office, 1952.

Chamberland, R.T. "Instrumentation Work on the Nature of Glacier Motion." *GJ* 36 (1928).

Chew, Allen F. *The White Death: The Epic of the Soviet-Finnish Winter War*. East Lansing: Michigan State University Press, 1971.

Clark, Ronald. *The Splendid Hill: The Life and Photographs of Vittorio Sella*. London: Phoenic House Limited, 1948.

________. *The Alps*. New York: Knopf, 1973.

Clark, Walter. *Photography by Infra Red*. John Wiley Co.: New York, 1939.

Cole, Terrence. *The Sourdough Expedition*. Anchorage: Alaska Journal, 1985.

Compton, Arthur. "A Geographic Study of Cosmic Rays." *PR* 42, no. 6 (15 March 1933).

________. "Cosmic Rays as Electrical Particles." *PR* 50 (December 1936).

Cook, Frederick. "America's Unconquered Mountain." *Harpers Monthly Magazine* (January and February 1904).

________. "The Conquest of Mount McKinley." *HMM* (May 1907).

________. *To the Top of the Continent*. London: Hodder & Stoughton, 1909.

________. *My Attainment of the Pole*. New York: The Polar Publishing Co., 1911.

________. *Return from the Pole*. New York: Pelligrini & Cudhay, 1951.

Cronan, William, George Miles and Jay Gitlin. "Becoming West: Toward a New Meaning for Western History." *Under an Open Sky: Rethinking America's Western Past*. New York: W.W. Norton, 1992.

Crone, D.R. "Mapping from the Air." *GJ* 84 (July 1934).

Cronin, Thomas, Thomas Gaisser and Simon Swordy. "Cosmic Rays at the Energy Frontier." *Scientific American* (January 1997).

Dall, William. *Alaska and Its Resources*. Boston: Lee and Shepard, 1870.

________. "Report on Mount Saint Elias, Mount Fairweather, and Some of the Adjacent Mountains," *USCS Annual Report 1875* (Washington, D.C.: Government Printing Office, 1875.

Dallek, Robert. *Franklin D. Roosevelt and American Foreign Policy, 1932-1945*. New York: Oxford University Press, 1981.

Davis, Loyal, et al. "High Altitude Frostbite: Preliminary Report." *Surgery, Gynecology and Obstetrics* 77 (December 1943).

De Fillipo, Filippi. *The Ascent of Mount St. Elias*. Westminster: Archibald Constable, 1900).

Desmond, Mary. *Museum of Science, Boston: The Founding Formative Years, The Washburn Era 1939-1980*. Boston. Museum of Science, 1989.

DeVorkin, David. *Race to the Stratosphere: Manned Scientific Ballooning in America*. New York: Springer-Verlag, 1989.

________. *Science With a Vengeance: How the Military Created the US Space Sciences After World War II*. New York: Springer-Verlag, 1992.

Dickey, William. "Discoveries in Alaska (1896)." *AAJ* (1951-1953).

Doel, Ronald. "Redefining a Mission: The Smithsonian Astrophysical Observatory on the Move." *Journal for the History of Astronomy* 21 (1990).

________. "Expedition and the CIW: Comments and Contentions." In Gregory Good, ed., *The Earth, the Heavens and the Carnegie Institution of Washington.* Washington, D.C.: American Geophysical Union, 1994.

________. *Solar Systems Astronomy in America: Communities, Patronage, and Interdisciplinary Science, 1920-1960.* New York: Cambridge University Press, 1996.

________. "The Earth Sciences and Geophysics." In John Krige and Dominque Pestre, eds., *Science in the Twentieth Century.* London: Hartwood Academic Press, 1997.

Dunn, Robert. "Across the Forbidden Tundra." *Outing Magazine* (January 1904).

________. "Into the Mists of Mt. McKinley." *OM* (February 1904).

________. "Storm-Wrapped on Mt. McKinley." *OM* (March 1904).

________. "Home by Ice and by Swimming from Mt. McKinley." *OM* (May 1904).

________. *Shameless Diary of an Explorer.* New York: The Outing Publishing Co., 1907.

Dupree, Hunter A. "The Great Instauration of 1940." In Gerald Holton, ed., The Twentieth Century Sciences: Studies in the Biography of Ideas.

________. *Science and the Federal Government: A History of Politics and Activities.* Baltimore: The Johns Hopkins University Press, 1986.

Dyson, James. *The World of Ice*. New York: Alfred Knopf, Inc., 1962.

Eames, Hugh. *Winner Lose All: Dr. Cook & the Theft of the North Pole*. Boston: Little, Brown and Company, 1973.

Editor. "Washburn Photographs Illuminate Geologic Features." *GSA Today* 5, no. 10 (15 October 1995).

Eldridge, George. "A Reconnaissance on the Sushitna Basin and Adjacent Territory, Alaska, in 1898." *Twentieth Annual Report of the United States Geological Survey* 7. Washington, D.C.: Government Printing Office, 1898-1899.

Elias, Scott. *The Ice-Age History of Alaskan National Parks*. Washington, D.C.: Smithsonian Institution Press, 1995.

Engle, Eloise and Lauri Pananen. *The Winter War: The Soviet Attack of Finland 1939-1940*. New York: Stackpole Books, 1992.

Fagen, George V. "Philip Washburn: 'A Thorough Colorado Man.'" *The Colorado Magazine* (Fall 1972).

Fairchild Aviation. "A Complete College Course in Aerial Photography: Institute of Geographical Exploration of Harvard University Gives Students Practical Training with Modern Fairchild Equipment." *Fairchild Aviation News* (February 1937).

Farquhar, Francis. "The Exploration and First Ascents of Mount McKinley." *Sierra Club Bulletin* (June 1949).

Field, William. "The Fairweather Range: Mountaineering and Glacier Studies." *Appalachia* (December 1926).

________. *Mountain Glaciers of the Northern Hemisphere*. Hanover: Cold Regions Research and Engineering Laboratory. 1927.

________. Glaciological Research in Alaska. In Henry B. Collins, *Science in Alaska.* Washington: The Arctic Institute of North America, 1952.

________. *Some Aspects of Glaciers and Glaciology.* Washington, D.C.: Naval Operations for Polar Projects, 1956.

________. *Geographic Study of Mountain Glaciation in the Northern Hemisphere: Alaska and Adjoining Parts of Canada,* Part 2a. New York: American Geographical Society, 1958.

Fisher, J.E. "Forbes and Alaskan 'Dirt' Bands on Glaciers and Their Origins." *American Journal of Science* 245 (1947).

________. "The Formation of Forbes Bands." *JG* 1 (1958)

Flemer, J.A. "Photographic Methods and Instruments." *United States Coast and Geodetic Survey Report for 1897.* Washington, D.C.: Government Printing Office, 1898).

Fleming, James. *Meteorology in America: 1800-1896.* Baltimore: The Johns Hopkins University Press, 1990.

Forbes, Alexander. "Surveying in Northern Labrador." *GR 22* (1932).

________. "A Flight to Cape Chidley, 1935." *GR 29* (1936).

Forbes, John D. *Travels Through the Alps of Savoy.* Edinburgh: Simpkin, 1843.

________. *The Theory of Glaciers.* Edinburgh: Simpkin, 1859.

Forbush, Scott. "Some Recollections of Experience Associated with Cosmic-Ray Investigation." In Yataro Sekeido and Harry Elliot, ed., *Early History of Cosmic Ray Studies: Personal Reminiscences With Old Photographs.*

Freeman, Andrew. *The Case for Dr. Cook*. New York: Coward-McCann, Inc., 1961.

Gaddis, Lewis. *The Long Peace: Inquiries Into the History of the Cold War*. New York: Oxford University Press, 1987.

Gahagan, Neil. "The Mountain Tamer." *Bee-Hive*, (January 1950).

Garfield, Brian. *The Thousand Mile War: World War II in Alaska and the Aleutians*. New York: Bantam, 1982.

Garrett, W.E. "Grand Canyon: Are We Loving it to Death?" *NGM* (July 1978).

Gilbert, Grove Karl. *Harriman Alaska Expedition*, vol. 3. New York: Doubleday, Page & Co., 1903.

________. *Glaciers and Glaciation*. Washington, D.C.: Smithsonian Institution, 1910.

Goddard, George. "The Unexplored Philippines From the Air." *NGM* (September 1930).

Goetzmann, William. *Exploration and Empire: The Explorer and the Scientist in the Winning of the American West*. New York: Norton, 1978.

________. "Paradigm Lost." In Nathan Reingold *The Sciences in the American Context: New Perspectives*. Washington D.C.: Smithsonian Institution Press, 1979.

________. *Looking Far North: The Harriman Expedition to Alaska, 1899*. Princeton: Princeton University Press, 1982.

________. *New Lands, New Men: America and the Second Great Age of Exploration*. New York: Viking Penquin Inc., 1987.

Goldthwait, Richard. "Seismic Sounding on South Crillon Glacier." *GJ* 87 (June 1936).

________. "Dating the Little Ice Age in Glacier Bay, Alaska." report on the International Geological Congress 21st Session." *Nordon* (1963).

Goldthwait, Richard, Ian McKeller and Casper Cronk. "The fluctuations of Crillon Glacier System, Southeast Alaska." *Bulletin of the International Association of Sci. Hydrology* 8 (1963).

Graham, Ronald and Roger Mead. *Manual of Aerial Photography.* London: Focal Press, 1986.

Grattan, H.W. "Trench Foot." In *History of the Great War Based on Official Documents.* London: His Majesty's Stationary Office, 1922.

Gray, George. *Science at War.* Freeport: Books for Libraries Press, 1972.

Green, Lewis. *The Boundary Hunters.* Vancouver: University of British Columbia, 1982).

Gregory, Barry. *Mountain and Arctic Warfare: From Alexander to Afghanistan.* Wellingborough: The Bath Press, 1988.

Griffiths, Thomas. "Glacial Geomorphology on the Mt. McKinley Massif, Alaska." *Proceedings of the VIIIth General Assembly-XVIIth Congress, International Geographical Union.* (1952).

Grosvenor, Gilbert. *The National Geographic Society and Its Magazine.* Washington, D.C.: National Geographic Society, 1957.

Hambrey, Michael and Jurg Alean. *Glaciers.* Cambridge: University of Cambridge Press, 1992.

Hamilton, Thomas, Katherine Reed, Robert Thorson, eds. *Glaciation in Alaska: The Geologic Record.* Anchorage: Alaska Geographic Society, 1986.

Harvard University. *Harvard University Handbook: An Official Guide*. Cambridge: Harvard University Press, 1936.

Henning, Robert, Barbara Olds and Penny Rennick. *Alaska's Glaciers.* Anchorage: Alaska Geographical Society, 1982.

Henson, Matthew. *A Negro Explorer at the North Pole*. New York: Stokes, 1912.

Herbert, Wally. *The Noose of Laurels.* New York: Atheneum

Herron, Joseph. *Explorations in Alaska, 1899*. Washington, D.C.: War Department, 1899.

Hershberg, James. *James Conant: Harvard to Hiroshima and the Making of the Nuclear Age*. New York: Alfred Knopf, Inc., 1993).

Hevly, Bruce. "The Heroic Age of Glacier Motion." *Osiris* 11 (1996).

High Magazine Sports. "Alpine Special." *High Mountain Sports* (February 1995).

Hillas, A.M. *Cosmic Rays*. Oxford: Pergamon Press, 1972.

His Majesty's Stationary Office. *Medical and Surgical History of the British Army During War Against Russia in Years 1854-56*. London: His Majesty's Stationary Office, 1858,

Hodges, Thomas. *The Alaska-Canada Boundary Dispute*. Toronto: William Tyrell and Co., 1903).

Holzel, Tom and Audrey Saulkeld. *First on Everest: The Mystery of Mallory and Irvine.* New York: Paragon House Publishers, 1988).

House, William. "Mountain Equipment for the U.S. Army." *AAJ* (1946).

Hunt, William. *To Stand at the Pole.* New York: Stein and Day, 1981.

________. *Mountain Wilderness.* Washington, D.C.: Government Printing Office, 1991.

Huntsford, Roland. *The Last Place on Earth.* New York: Athenium, 1986.

Kamb, Barclay, et al. "Glacier Surge Mechanism: 1982-1983 Surge of Variegated Glacier, Alaska." *Science* 227, no 4686 (February 1985).

Kari, James. "The Tenada-Denali-Mount McKinley Controversy." *Names* 34, no. 3 (September 1986.

Kevles, Daniel. *The Physicists: The History of a Scientific Community in Modern America.* Cambridge: Harvard University Press, 1995.

King, C and W. Lewis. "A Tentative Theory of Ogive Formation." *JG* 3 (1961).

Kirwin, L.P. *A History of Polar Exploration.* New York: Norton, 1960.

Klotz, O.J. "Notes on the Glaciers of Southeastern Alaska and Adjoining Territory." *GJ* 14 (1899).

Kohler, Robert. *Partners in Science: Foundations and Natural Scientists, 1900-1945.* Chicago: University of Chicago Press, 1991.

Krashieninnikov, Stephan P. *Explorations of Kamchatka: 1735-41.* Portland: Oregon Historical Society, 1972.

Kuklick, Henrika and Robert Kohler, ed. Science in the Field. *Osiris* 11 (1996).

La Perouse, Jean Francis. *A Voyage Around the World,* Vol. 1. London: Joseph Bumstead, 1979.

Langar, William and S. Everett Gleason. *The Undeclared War*. New York: Harper and Brothers Publishing, 1953.

Laprince-Ringuet, Louis, Trans., Fay Ajzenberg. *Cosmic Rays*. New York: Prentice Hall, 1950.

Larrey. Memories d'un Chirurgien Milit. et de Campagne. In Hans Killiam, *Cold Injuries With Special Reference to German Experience During World War II*. Washington, D.C: United States Navy, 1952.

Leslie, Stuart. *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford*. New York: Columbia University Press, 1993.

Leuchtenburn, William E. *Franklin D. Roosevelt and the New Deal: 1932-1940.* New York: Harper & Row, 1963.

Livingstone, David. *The Geographical Tradition: Episodes in the History of a Contested Enterprise*. Cambridge: Blackwell, 1992.

Lucier, Paul. "Commercial Interests and Scientific Disinterestedness: Consulting Geologists in Antebellum America." *Isis* 86, no. 2 (June 1995).

Lund, Arnold. *A Century of Mountaineering: 1857-1957.* George Allen & Unwin Ltd., 1957.

Lutz, Catherine and Jane Collins. *Reading National Geographic*. Chicago: The University of Chicago Press, 1993.

Mackiner, Halford J. "On the Scope and Methods of Geography." *Proceedings of the Royal Geographical Society* 9 (1887).

MacPherson, W.H. "The Russo-Japanese War." In *Medical and Sanitary Reports from Officers Attached to the Japanese Forces in the Field*. London" his Majesty's Stationary Office, 1908.

Mathis, F.E. "Glaciers." *Hydrology, Physics, of the Earth - IX*. New York: Dover, 1942.

McKinley, Ashley C. *Applied Aerial Photography*. New York: John Wiley & Sons, Inc., 1929.

McNeill, William. *Plagues and People*. Garden City: anchor Press, 1976.

Mendenhall, William. "A Reconnaissance From Resurrection Bay to Tanana River, Alaska." *Twentieth Annual Report of the United States Geological Survey* 7. Washington, D.C.: Government Printing Office, 1900.

Merriam, C Hart, ed. *Harriman Alaska Expedition*, 13 vols. Washington, D.C.: 1910 - 1914.

Mertie, J.B. "Geography and Geology of Lituya Bay." In Phillip Smith, *Mineral Resources of Alaska*. Washington, D.C.: Government Printing Office, 1930.

Military Engineer. "Elevation of Mt. McKinley." *Military Engineer* 48 (1956).

Miller, Maynard. "Observations on the Regimen of Glaciers of Icy Bay and Yakatat Bay, Alaska, 1946-47." Master's Thesis. New York: Columbia University, 1948)

________. "Observations on the Regimen of the Glaciers of Icy Bay and Yakatat Bay, Alaska: 1946-1947." *Special Report: Foundation for Glacial Research*. Seattle: Foundation for Glacial Research, 1955.

________. "The Role of Diastrophism in the Regimen of Glaciers in the St. Elias District, Alaska." *JG* 3 (1958).

Moiseevich, Aleksander. *June 22, 1941: Soviet Historians and the German Invasion*. Trans. and ed., Vladamir Petrov. Columbia: University of South Carolina Press, 1968.

Molnia, Bruce and Austin Post. "Holocene History of Bering Glacier, Alaska: A Prelude to the 1993-94 Surge." *Physical Geography* 16 (March-April 1995).

Montgomery, M.R. *In Search of L.L. Bean*. Boston: Little, Brown & Company, 1984.

Moore, Terris. *The Pioneer Climbs of Mount McKinley*. Fairbanks: University of Alaska Press, 1967.

Morison, Elting Elmore. *Turmoil and Tradition: A Study of the Life and Times of Henry L. Stimson*. Boston: Houghton Mifflin, 1960.

Mothes, Hans. "Dickenmessungen von Gletschereis mit Seismischen Methoden." *Zeitschrift fut Geophysik* 3 (1927).

Muir, John. *John Muir: Travels in Alaska*. Boston: Houghton Mifflin Company, 1979.

Nash, Gerald D. *Creating the West: Historical Interpretations, 1890-1900*. Albuquerque: University of New Mexico Press, 1991.

National Geographic Magazine. "Father Hubbard's Alaskan Explorations." *NGM* (May 1934).

Needell, Allan. "Lloyd Berkner and Science-Statesmanship." In Peter Galison and Bruce Hevly, ed., *Big Science: The Growth of Large-Scale Research*. Stanford: Stanford University Press, 1992).

Newburgh, Louis. *Physiology of Heat Regulation and the Science of Clothing*. Philadelphia: W.B. Saubders, 1949.

Nielson, Jonathan. *An Interpretive Survey of Alaska's Military Heritage: 1867-1980*. Anchorage: Alaska Historical Commission, 1980.

Oleson, Alexander and John Voss, ed. *The Organization of Knowledge in Modern America, 1860-1920*. Baltimore: The Johns Hopkins University Press, 1979.

Orr, K.D. and D.C. Fainer. *Cold Injuries in Korea During Winter 1950-51.* Fort Knox: Army Medical Research Laboratory, 1951.

Owens, Larry. "The Counterproductive Management of Science in the Second World War: Vannevar Bush and the Office of Scientific Research and Development." *Business History Review* 68, no. 4 (Winter 1994).

Page, C.M. "Gangrene in War." *British Medical Journal* (August 1914).

Pauly, Philip. "The World and All That's in It: The National Geographic Society, 1888-1918." *American Quarterly* 31, no. 4 (1979)

Peary, Marie. *The Snow Baby.* Cambridge; The University Press, 1901).

Peary, Robert E. *The North Pole*. New York: Stokes, 1910.

Pierce, Richard and Alexander Doll. "Alaskan Treasure: Our Search for the Russian Plates." *Alaskan Journal* 1, no. 1 (1971).

Pitkin, Thomas. *Quartermaster Equipment for Special Forces.* Washington, D.C.: Quartermaster Corps Historical Studies, 1944.

Post, Austin. "Effects of the March 1964 Alaskan Earthquake on Glaciers." *USGSPP* 544-D (1967).

________. "Annual Aerial Photography of Glaciers in Northwest North America: How it all Began and its Golden Age." *Physical Geography* 16, no. 1 (January-February 1995).

Public Information Officer Headquarters. *The Army's Role in the Building of Alaska*. Seattle: Headquarters United States Army, Alaska, 1969.

Purtee, Edward. *Development of Army Air Force Clothing and Other Personal equipment Peculiar to Air Operation*. Wright Field: Air Technical Service Command, 1945.

Putnam, D.P. "Geography is a Practical Subject." In Griffith Taylor, ed., *Geography in the Twentieth Century: A Study of Growth, Fields, Techniques, Aims and Trends*. New York: Philosophical Library, 1951.

Pyne, Stephen. "From the Grand Canyon to the Marianas Trench: The Earth Sciences After Darwin." In Reingold 1979.

________. "A Third Great Age of Discovery." In Martin Collins and Sylvia Kraemer, ed. *Space: Discovery and Exploration*. Hong Kong: Hugh Lauter Levin Associates, 1993.

Quartermaster Corps. *Report of the U.S. Army Alaskan Test Expedition, 1942*. Washington, D.C.: Office of the Quartermaster Corps, 1942.

Rabbit, Mary. *Minerals, Lands, and Geology for the Common Defence and General Welfare*, 3 vols. Washington D.C.: Government Printing Office, 1979.

Rawlins, Dennis. *Peary at the Pole: Fact or Fiction*. New York: Robert B. Luce, Inc., 1973.

Read, Ben. "An Interview with Bradford Washburn and Terris Moore." *Climbing* (April 1993).

Read, Harry Fielding. "Studies of Muir Glacier, Alaska." *NGM* 4 (21 March 1892).

Reed, John C. "Record of the First Approach to Mt. McKinley." *AAJ* (1955).

Reingold, Nathan. *The Sciences in the American Context: New Perspectives*. Washington, D.C.: Smithsonian Institution Press, 1979.

Riffenburgh, Beau. *The Myth of the Explorer: The Press, Sensationalism, and Geographic Discovery*. London: Bellhaven Press, 1993.

Risch, Erna. *U.S. Army in World War II, The Quartermaster Corps: Organization, Supply and Services*, vol. 1. Washington, D.C.: Government Printing Office, 1953.

Roberts, David. *Great Exploration Hoaxes*. San Francisco: Sierra Club Books, 1982.

________. "The Legacy of Washburn." In Bradford Washburn and David Roberts, Mount McKinley: The Conquest of Denali, 1991.

Robinson, Arthur H. "Geographic Cartography." In Preston James and Claren F. Jones, ed., *American Geography: Inventory and Prospect*. Syracuse: Syracuse University Press, 1954.

Rohn, Oscar. "Survey and Opening Up a Military Road from Valdez to Copper Center, 1899." *Compilation of Narratives of Explorations in Alaska*. Washington, D.C.: Government Printing Office, 1900.

Ross, Dorothy. *The Origins of American Social Sciences*. New York: Cambridge University Press, 1991.

Rossi, Bruno, Mathew Sand and Robert Sard. "Measurement of the Slow Mesotron Intensity at Several Altitudes." *PR* 72 (15 July 1947).

________. *Cosmic Rays*. New York: McGraw-Hill Book Company, 1964.

Rusk, Claud. "On the Trail of Dr. Cook." *Pacific Monthly* (January 1911).

Russell, Israel. "An Expedition to Mount St. Elias, Alaska." *National Geographic Magazine* 29 (May 1891).

________. *Glaciers of North America*. Boston: Ginn & Company, 1897.

Salt, J.S. "Photographs Form the Mount Everest Flight." *GJ* 82 (July 1933).

Sapolsky, Harvey. "Academic Science and the Military: The Years Since the Second World War." In Reingold 1979.

Sargent, R.H. and F.H. Moffit. "Aerial Photographic Surveys in Southeastern Alaska." *USGSB* 797-E. Washington, D.C.: Government Printing Office, 1929.

Saulkeld, Audrey. "Skinning One Skunk at a Time." *Mountain* 126 (March/April 1989).

Schein, Marcel, William Jesse and E.D. Wollen. "Intensity and Rate of Production of Mesotrons in the Stratosphere." *PR* 57 (1940).

________. "The Nature of the Primary Cosmic Radiation and the Origin of the Mesotron." *PR* 69 (1941).

Scott, Robert F, Leonard Huxley, ed. *Scott's Last Expedition: being the journals of Captain R.F. Scott, R.N., C.V.O.* London: Smith, Elder & Co., 1913.

________. *Scott's Last Expedition: The Journals*. London: Murray, 1987.

Sekido, Yataro and Harry Elliot. *Early History of Cosmic Rays" Personal Reminiscences with Old Photographs*. Dordrecht: D. Reidel Publishing Company, 1985.

Seligman, Gerald. "Research on Glacier Flow." *Geografiska Annaler* (1949).

Sharp, Robert. *Living Ice*. Cambridge: Cambridge University Press, 1988).

________. *Glaciers*. Eugene: University of Oregon, 1990.

________. *Living Ice: Understanding Glaciers and Glaciation*. New York: Cambridge University Press, 1992.

Shelton, John. *Geology Illustrated*. San Francisco: W.H. Freeman and Company, 1966.

Sherwood, Morgan. *Exploration of Alaska: 1865-1900*. Fairbanks: University of Alaska Press, 1993.

Simpitch, Frederick. "Skypaths Through Latin America." *NGM* (January 1931).

Smith, Janet Adam. *John Buchan*. London: Rupert Har-Davis, 1965.

Smith, Neil. "Academic War Over the Field of Geography: The Elimination of Geography at Harvard, 1947-1951." *Annals of the Association of American Geographers* 77, no. 2 (June 1987).

Sorrenson, Richard. "The Ship as Scientific Instrument in the Eighteenth Century." *Osiris* 11 (1996).

Spurr, Josiah. "A Reconnaissance in Southeastern Alaska in 1898." *Twentieth Annual report of the United States Geological Survey* 7. Washington, D.C.: Government Printing Office, 1900.

Spurr, Josiah and Stephen Spurr. *The Log of the Kuskokwim: An Exploration in Alaska*. Spurr: Petersham, 1950.

Stefannson, Vilhjalmur. *The Friendly Arctic*. New York: The MacMillan Company, 1943.

Steller, George Wilhelm. *Journal of a Voyage with Bering 1741-1742*. Palo Alto: Stanford University Press, 1988.

Stevens, Albert. "Exploring the Valley of the Amazon in a Hydroplane." *NGM* (April 1926).

________. "Flying the Hump of the Andes." *NGM* (May 1931).

________. "Photographing the Eclipse of 1932 From the Air: Five Miles Above the Earth Surface...." *NGM* (November 1932).

Stuck, Hudson. *The Ascent of Denali: A Narrative of the First Complete Ascent of the Highest Peak in North America*. Nebraska: University of Nebraska Press, 1914.

________. *The Ascent of Denali*. Lincoln: University of Nebraska Press, 1989.

Sweeting, C.G. *Combat Flying Clothing*. Washington, D.C.: Smithsonian Institution Press, 1984.

________. *Combat Flying Equipment: U.S. Army Aviators' Personal Equipment, 1917-1945*. Washington, D.C.: Smithsonian Institution, 1989.

Tarr, Ralph. "Recent Advances of Glaciers in the Yakatat Bay Region." *BGSA* 18 (1907).

________. "The Yakatat Bay Region, Alaska: Part 1, 'Physiography and Glacial Geology.'" *United States Geological Survey Professional Paper* 64. Washington, D.C.: Government Printing Office, 1912.

Tarr, Ralph and Lawrence Martin. "Glaciers and Glaciation of Yakatat Bay, Alaska." *American Geographical Society* 38 (1906).

________. *Alaskan Glacier Studies.* Washington, D.C.: National Geographic Society, 1914.

Tevor, Lever H. "Vilhjamur Stefansson, the Continental Shelf, and a New Arctic Continent." *British Journal for the History of Science* 21 (1988).

Thatcher, James. *Military Journal of the American Revolution.* Hartford: Hurlbert William and Co., 186d2.

The Telegraph Review. "Edward J. Hall: vice-president of the American Telephone and Telegraph Co., Died at Watkins, N.Y. September 17, 1914." *The Telegraph Review* (October 1914).

Tissot, Roger. *Mont Blanc.* London: The Medici Society Limited, 1924.

Toulmin, Stephen E. Cosmopolis: *The Hidden Agenda of Modernity.* New York: Free Press, 1990.

Turner, Frederick Jackson. *The Frontier in American History.* New York: Henry Holt and Company, 1921.

Ullman, James Ramsey. *The White Tower.* Philadelphia: J.B. Lippincott Company, 1945.

Vancouver, George. *A Voyage of Discovery to the North Pacific.* London: Hakluyt Society, 1801.

Waddington, E.D. "Wave Ogives." *JG* 32 (1982).

Wahrhaftig, Clyde. "The Alaska Range." In Howell William, ed., *Landscapes of Alaska: Their Geological Evolution.* Berkeley: University of California Press, 1958.

War Department. *Basic Field Manual: Operations in Snow and Extreme Cold*. Washington, D.C.: Government Printing Office, 1941.

War Department. *Quartermaster Corps, Specifications No. 1171 for Alaskan Clothing*. Washington, D.C.: Government Printing Office, 1914.

Washburn, Bradford. "Fishing: What a Boy Thinks." *The Churchman* (31 May 1919).

________. *The Trails and Peaks of the Presidential Range of the White Mountains*. Worcester: The Davis Press, 1926.

________. "A Boy on the Matterhorn." *The Youth's Companion* (17 March 1927).

________. "I Climb Mont Blanc." *The Youth's Companion* (30 June 1927).

________. *Among the Alps with Bradford*. New York: G.P. Putnam's Sons, 1927.

________. *Bradford on Mount Washington*. New York: G.P. Putnam's Sons, 1928.

________. "The First Ascent." *The Sportsman* (March 1930).

________. "Back-Packing to Fairweather." *The Sportsman* (April 1931).

________. *Bradford on Mt. Fairweather*. New York: G.P. Putnam's Sons, 1931.

________. "The Conquest of Mount Crillon." *NGM* (March 1935).

________. "Morainic Banding of Malaspina Glacier and Other Alaskan Glaciers." *BGSA* 46, (1935).

________. "Exploring Yukon's Glacial Stronghold." *NGM* (June 1936).

________. "Over the Roof of the Continent." *NGM* (July 1938).

________. "A Preliminary Report on the Studies of the Mountains and Glaciers of Alaska." *GJ* 98 (1941).

________. *United States Army Air Forces: Report on Results of Field Tests and Conferences on Equipment, Alaska, June-July-August, 1942*. Dayton: United States Army Air Forces, 1942.

________. *Association with the Material Center, Wright Field, Dayton, Ohio, from January 1942 Until March 1943*. Dayton: United States Army Air Corps, 1943.

________. "Personal Equipment." *AAJ* (1946).

________. "Mount McKinley from the North and West." *AAJ* (1947).

________. "First Ascent of Mount Deception." *Sierra Club Bulletin* 36, no. 5 (1951).

________. "Mount McKinley: The West Buttress, 1951." *AAJ* (1952).

________. "Mount McKinley (Alaska): History and Evaluation." In Malcolm Barnes, ed., *The Mountain World*. New York: Harper & Brothers, 1957.

________. *A Map of Mount McKinley, Alaska*. Waben: Swiss Federal Institute of Topography, 1960.

________. " A New Map of Mount McKinley, Alaska: The Story of a Cartographic Project." *GR* 51 (April 1961).

________. "Aerial Photography: Alaska and the Alps. In Malcolm Barnes, ed., *The Mountain World*. Chicago: Rand McNally & Company, 1961.

________. "Frostbite: What It Is - How to Prevent It - Emergency Treatment." *New England Journal of Medicine* 266 (10 May 1962).

________. "Oblique Aerial Photography of the Mount Hubbard-Mount Kennedy Area on the Alaska-Yukon Border." *NGSRR 1966 Projects.*

________. "The Mapping of Mount Hubbard and Mount Kennedy, 1965." *National Geographic Research Reports, 1965 Projects*. Washington, D.C.: National Geographic Society, 1971).

________. "First Laser Measurements to the Summit of Mount McKinley." *AAJ* (1978).

________. "The Heart of the Grand Canyon." *NGM* (July 1978).

________. "Mount Everest: Surveying the Third Pole." *NGM* (November 1988).

Washburn, Bradford and Richard Goldthwait. "Lituya Bay and Mount Crillon District." *GJ* 87, supplement (June 1936).

________. "Movement of South Crillon Glacier, Crillon Lake, Alaska." *Bulletin of the Geological Society of America* 48 (1 November 1937).

Washburn, Bradford, Adams Carter and Ann Carter. "Dr. Cook and Mount McKinley." *AAJ* (1958).

Washburn, Bradford, Hugo Kasper and Ernst Huber. *Mount McKinley, Alaska: A Reconnaissance Topographic May by Bradford Washburn*. Waben: Neue Zurcher Zeitung, 1960.

Washburn, Bradford, Robert Kennedy and James Whittaker. "Canada's Mount Kennedy." *NGM* (July 1965).

Washburn, Bradford and David Roberts. *Mount McKinley: The Conquest of Denali*. Harry N. Abrams, 1991.

Wavell, Sven. *The American Expedition*. London: William Hodge and Company, 1952.

Whayne, Tom and Michael DeBakey. Cold Injury, *Ground Type*. Washington, D.C.: Government Printing Office, 1958.

Wickersham, James. "The Creation of Denali (Mount McKinley), By Yako, the Athabascan Adam: A Legend of the Yukon Tena Indians." *Alaska Magazine* 1, no. 1 (January 1927).

Wickersham, James. *Old Yukon: Tales, Trails and Trials*. Washington, D.C.: Washington Law Book Co., 1938.

Wilson, J.T. "Glacial Geology of Part of Northwestern Quebec." *Transactions of The Royal Society of Canada* 32, section 4 (May 1938).

Wilson, J.T. "Structural Features in the Northwest Territories." *American Journal of Science* 239 (1941).

Wood, Walter A. "The Wood Yukon Expedition of 1935: An Experiment in Photographic Mapping." *Geographical Review* 26 (1936).

________. "Parachuting of Expedition Supplies: An Experiment by the Wood Experiment by the Wood Yukon Expedition of 1942." *GR* 32 (January 1942).

Wrangell, Ferdinand P. von. *Statistiche und Ethnographishe Nachrichten uber die Russischen Bestzungen an der Nordewestkuste von Amerika*. St. Petersburg: Imperial Academy of Science, 1839.

Wright, Frederick G. "The Muir Glacier." *American Journal of Science*, series 3 (1887).

Wright, John. "The Field of the Geographical Society." In Griffith Taylor, ed., *Geography in the Twentieth Century: A Study of Growth, Fields, Techniques, Aims and Trends*. New York: Philosophical Library, 1951.

Zaslow, Morris. *Reading the Rocks: The Story of the Geological Survey of Canada 1842-1972*. Toronto: The MacMillan Company of Canada Limited, 1975.

Newspapers Cited

Anchorage Daily News

Anchorage Hi-Life

Boston Herald

Champaign-Urbana News

Fairbanks Daily News-Miner

Fairbanks Daily Times

New York Sun

New York Times

The Illustrated London News

Third Form Weekly

APPENDIX A

Acronyms and Initialisms

AAAS	American Association for the Advancement of Science
AML	Aero Medical Laboratory
ETO	European Theater of Operation
GPS	Global Positioning System
GSA	Geological Society America
NGS	National Geographic Society
NRC	National Research Council
ONR	Office of Naval Research
OSRD	Office of Scientific Research and Development
USGS	United States Geological Survey
USCS	United States Coast Survey
USCGS	United States Coast and Geodetic Survey
QMC	Quartermaster Corps

APPENDIX B

Archival Sources

AIP	American Institute of Physics. Center for History of Physics, Oral History Program, College Park, Maryland.
BWC	Bradford Washburn Collection, University of Alaska Fairbanks, Rasmuson Library, Alaska and Polar Regions Archives, Fairbanks, Alaska.
BWPP	Bradford Washburn Personal Papers (To be added to the Bradford Washburn collection at the University of Alaska Fairbanks), Fairbanks, Alaska.
AFHRA	Air Force Historical Research Agency, Maxwell AFB, Alabama
DPL	10th Mountain Division Files, Denver Public Library, Denver, Colorado.
FDR	Franklin Delano Roosevelt Papers - Franklin Delano Roosevelt Library, Hyde Park, New York.
NGS	Gilbert Grosvenor Files - National Geographic Society Archives, Washington, D.C.
HU	Committee on Experimental Geology - Harvard University Archives, Cambridge, Massachusetts.

LBJ	Lyndon Baines Johnson Papers - Lyndon Baines Johnson Library, Austin, Texas.
LDPP	Loyal Davis Personal Papers (To be added to the Bradford Washburn Collection), Fairbanks, Alaska.
SIOA	ONR - Scripps Institute of Oceanography, University of San Diego, San Diego, California.