



UAA College of Engineering  
UNIVERSITY of ALASKA ANCHORAGE

UAA Professional Development Seminar Series

## Climate Change Impacts to Arctic Airfields

Presented by: James J. Frye, M.S., P.M.P.,  
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Technology



**ABSTRACT:** This study aims to gain a greater understanding of pavement performance and rehabilitation recurrence in dynamic permafrost conditions. This open-ended research investigates the correlation between climate history, climate change, and pavement infrastructure performance for specific airfields in Arctic and Subarctic Alaska. Climate parameters such as temperature, air indices, and permafrost extent are compared to PAVER pavement management system data and construction costs for four locations. PAVER data, geotechnical reports, and construction costs are provided by the Alaska Department of Transportation and Public Facilities and the United States Air Force Civil Engineer Center. Site criteria are developed and implemented to select airfields for analysis that provide representative conditions. Priorities for selection include relevance to Department of Defense operations, availability and completeness of historical pavement and geotechnical data, typical soil conditions, and geographical location with varying levels of permafrost extent. Climate data is analyzed to show the range of variability and temporal trends. Geotechnical borehole data is consolidated to portray nominal local permafrost extent. Data trends show that the depth of upper extent of permafrost at locations is increasing with time. PAVER family degradation curves compare the degradation rate among selected Arctic and Subarctic Alaska airports to locations in the contiguous United States. Regression of Pavement Condition Index (PCI) degradation rate and permafrost extent is used for correlation analysis. Other factors potentially influencing the degradation rate, including preventive maintenance, aircraft operations, construction history, and soil conditions, are

detailed for each location and factored for latitude. Construction cost histories from the Federal Aviation Administration Airport Improvement Program grant archives are included in trend analyses. Cost estimates for typical maintenance treatments are generated and applied to pavement inspections to model maintenance requirements and predict changes in airfield rehabilitation frequency. More accurately assessing the potential impact of airfield rehabilitation rates on operational availability and mission supportability as a function of changing climate conditions can better predict long-range program requirements. Expanding knowledge in this area provides critical infrastructure owners with valid, credible data to predictably enhance pavement asset management and long-term construction planning. Therefore, the results of this research will benefit future operations, transportation, and alignment of strategic goals for the Alaska Department of Transportation & Public Facilities and the Department of Defense.

**BIO:** James Frye is an Instructor of Civil Engineering at the Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio. James holds a Master of Science in Project Management from the University of Alaska Anchorage as well as a Bachelor of Science in Civil Engineering from Colorado State University. He has served a total of seven years as an Air Force Civil Engineer Officer. He was first assigned to the 673rd Civil Engineer Squadron at Joint Base Elmendorf-Richardson, Alaska as Officer-In-Charge of Construction Management. In this role, he oversaw a \$138M construction program and supervised 12 inspectors. In September 2018 he deployed to Gwangju Air Base, South Korea as Chief of Project Development while serving on 7th Air Force's Civil Engineer Project Development Team. Upon returning to JBER he served as Chief of Operations Engineering, leading 67 personnel to maintain, service, and repair the installation's \$15 billion worth of infrastructure including 2,300 facilities and 126 miles of roads. In 2020, James was appointed as Readiness and Emergency Management Flight Commander at the 773 Civil Engineer Squadron and led 23 personnel in providing emergency management services to an installation of 32,000 people. In 2021, James was selected to attend the Air Force Institute of Technology's Civilian Institute program to become an instructor at the Air Force's Civil Engineer School. In this role, he provides professional continuing education and consultation services in support of the U.S. Air Force and joint engineer operations. James teaches courses in Civil Engineering, Project Management, Troop Construction Project Management, and Cost Estimating. His research interests encompass infrastructure challenges in cold regions, and he has a proven track record of successfully leading projects in this domain. With a passion for Arctic studies, he

dedicated his master's research to investigating impacts of climate change on asphalt-paved airfields in Northern Alaska in conjunction with the Alaska Department of Transportation and Public Facilities.

Friday, November 10, 2023

11:45 am - 12:45 pm

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