The Exploring Greenland project, which was carried out as a joint venture between researchers from Aarhus University and Florida State University, and which throughout was generously supported by the Carlsberg Foundation, has put Greenland on the map in the history of postwar science and technology. It has shown that Greenland became an area of high scientific interest and activity for the USA, Denmark and other countries. Military interests by the USA and political considerations, sovereignty concerns in particular, by Denmark had a tremendous influence on the shaping of research efforts in Greenland. This pamphlet gives a brief survey of the main subprojects and their outcomes.
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During the early decades of the Cold War, Pentagon planners viewed Greenland—situated between the North American continent and the Soviet Union—as a vital territory for maintaining the security of the U.S. Consequently, the U.S. military built major military bases in western and northern Greenland and began planning an immense system of tunnels under the ice to hide intercontinental missiles to use against the Soviet Union if East-West tensions intensified into hot war. All of these efforts were part of a grand strategy termed North American Continental Defense, ultimately involving Strategic Air Command bombers flying along the perimeter of the Arctic, sets of early warning radar systems, and submarine patrols in the icy seas east of Greenland.

RONALD E. DOEL argues that North American Continental Defense was a technological system that, beyond simply placing fighter aircraft and surveillance systems in remote locations, required a great deal of new knowledge about the physical environment for these weapons systems to work. Aware that Soviet scientists were far ahead in understanding the conditions and natural rhythms of Arctic environmental phenomena, U.S. government officials and military leaders encouraged a wide range of research programs in Greenland, to rapidly gain knowledge they believed essential for national security. Among the unanticipated results of these efforts to understand regularities in Arctic natural phenomena were new insights suggesting the Earth’s climate was warming—long before this trend became a chief environmental concern by the late twentieth century.
SMALL STATE PREOCCUPATIONS

Science and Technology in the Pursuit of Modernization, Security, and Sovereignty

During World War II, US military bases in Greenland was important to American air strategy, providing landing and refueling zones for aircraft flying between Europe and the United States. In the immediate postwar years, as the Cold War warmed up, US presence in Greenland would continue to be crucial to America’s defense posture vis-à-vis the Soviet Union. Denmark, which had been occupied by Germany during the war and now found itself as a small state lying between the United States and the Soviet Union, wanted very much to assert its authority over its colony Greenland, and sought to use science and technology to secure its sovereignty, improve its security posture, and pursue modernization on behalf of the Greenlandic people. Danish politicians focused on two distinct parts of Greenland: the north, site of military installations and American-led scientific studies and technological development, and the south, where Greenlanders lived. By modernizing the country in a Danish way, Denmark hoped to simultaneously strengthen sovereignty claims and thus limit US activities in the north, and reduce American cultural influence in the south.

KRISTIAN H. NIELSEN argues that decolonization efforts were strongly related to Denmark’s desire to exploit natural resources, allow Greenlanders some measure of self-rule, and to push back on its overbearing security partner, the United States.
Weather Stations and Data in the Early Cold War

Denmark—occupied by German forces in 1940—lost control of Greenland during World War II. Needing access to Greenland’s territory as it entered the European conflict and desiring to keep the Germans from occupying that land as well, the United States took control of Greenland, providing military protection and supplies for the Greenlanders. Because Greenland was a critical stopover for military flights between the US and Europe, the US military established and expanded weather observation stations in the country. Immediately after the war, Denmark sought to regain control of the weather stations and their observational data despite a scarcity of resources. Thus the Ministry of Foreign Affairs of Denmark pushed the Danish Meteorological Institute and the Greenland Administration to minimize the need for American presence and support as they fulfilled their weather data obligations to the International Civil Aviation Organization (ICAO). The US military, however, not only wanted to continue operating these stations, but to build a chain of Arctic weather stations in northern Canada and Greenland (Project Arctops). Canada and Denmark, concerned about their sovereignty, were not pleased by this proposal. Although they could not say “no” to the United States, they did work to guard their sovereign interests.

MATTHIAS HEYMANN argues that weather stations not only provided meteorological information—they served as symbols for sovereignty, political, and military control.
Early in the Cold War, the discipline of glaciology underwent significant transformations: it became a vehicle for the construction of continental defense and security interests, as well as a mechanism for boosting national and scientific credentials. The opening of the Cold War created new and pressing practical needs to understand and operate in the Polar Regions. In the United States, these needs were directly related to continental security concerns: with Greenland’s geographical position as a stepping stone between the US and the USSR, military control of the island was a strategic necessity. But US operations in Greenland required a sophisticated understanding of the island’s environment – that is, a scientific understanding of ice and snow. As such, glaciology became intimately connected with the US polar science strategy. As part of the US military machine, glaciology gained unprecedented amounts of funding and support, and was co-opted into a massive organizational framework.

**JANET MARTIN-NIELSEN** suggests that between 1948 and 1966, US forces in Greenland were entrenched in the ‘other cold war’: the struggle with the ice sheet environment which threatened to impede American capabilities in the region. Greenland’s exceptional geography and environment forced the US military to reassess its relationship with nature: rather than striving for control over the island space, US military personnel ultimately chose strategic cooperation with that space.
In the twenty years following World War II, three diverse, non-overlapping groups—one under US auspices and two under Danish auspices—were creating geological knowledge in Greenland: civilian geologists from the U.S. Geological Survey (USGS) Military Branch working in northern Greenland, an international team of geologists of the Danish East Greenland Expeditions (1947-1959) led by Danish geologist Lauge Koch working in eastern Greenland, and geologists of the Danish Geological Survey of Greenland (GGU) working in western Greenland.

Focusing on the US group in the north and Lauge Koch’s group in the east, CHRISTOPHER RIES argues that the US group’s ultimate mission was to enhance the ability of military units to operate not only in North Greenland, but in similar terrains and climates near the Arctic. The resulting operational techniques were successfully applied, for example, in Alaska, but the rather sketchy scientific output never reached a large scientific audience. Koch’s mission to secure natural resources and enhance scientific sovereignty, and ultimately political sovereignty, for the Government of Denmark, also met with mixed success. Although he found the natural resources, the cost of extraction generally exceeded their economic value. While both stories illustrate how time-limited interests can shape scientific efforts of diverse groups, the efforts of the USGS Military Geology Branch and of Lauge Koch both have meaning today. Interdisciplinary efforts practiced by the USGS Military Branch now foreshadow current methods of climate research, while mineral deposits discovered by Koch are currently being re-investigated for exploration.
Efforts to secure reliable long distance radio communications in the 1930s led nations such as the United States to install networks of ionospheric stations to conduct research on geomagnetic disturbances that could interrupt radio wave transmissions. World War II increased the importance of these stations, and by the end of the war, the US Bureau of Standards emerged as the world’s leading agency for forecasting “radio weather.” Cold War tensions and the resulting military importance of the Arctic boosted this research in Greenland, with the Danes operating a station in Godhavn (1951) and the US Army Signal Corps operating stations at US bases in Narssarssuaq (1950) and Thule (1955). Since the Danes had no tradition in this field, those interested in pursuing ionospheric research needed to cooperate and collaborate with US agencies (Air Force/Army/Bureau of Standards). In return for providing the scientific and technical manpower, the Danes received access to the instrumentation necessary to conduct this crucial military-related research.

Of special importance, HENRIK KNUDSEN argues, as a result of an informal “gentlemen’s agreement” between the Bureau of Standards and the Danish researchers, the Danish scientists collected classified data for the United States and kept it secret, willingly participating as equal partners. In this case, we see scientific and technological knowledge as a co-product of a transnational endeavor supporting military efforts, and yet unproblematic in a way that other scientific/technological efforts in Greenland were not.
Before the Cold War, seismology—the study of earthquakes and the movement of seismic waves—was hampered by the lack of agreed upon methodologies, standardized instruments, and research funding. With the spread of nuclear technologies in the 1950s, the US military made a priority of developing scientific means for detecting nuclear bomb explosions at a long distance. Seismology could offer such means because (underground) explosions created seismic waves similar to those of earthquakes. As a result, government funding for seismic research increased dramatically in the USA. But military agencies would need access to locations outside the United States in order to place the necessary instruments. In fact, American military agencies sought to get access to knowledge and localities in Greenland by engaging Danish seismologists in research projects with US scientific institutions. Denmark’s Seismic Section initially accepted the US co-option of their research turf, because it gave them some degree of access to the growing American seismic research community.

However, LIF JACOBSEN argues that as Denmark’s own disarmament policy increasingly directed the research activities at the Seismic Section, the relationship to US agencies became more complex and politically charged with each side pursuing its own agendas. Danish seismic science became heavily influenced by Cold War geopolitics.
Camp Century, the “City under the Ice,” was one of the US military’s most striking achievements in Greenland. A nuclear-powered army base constructed at the height of the Cold War by the US Army Corps of Engineers, the camp primarily served military purposes as the test site for innovative polar construction, including the portable nuclear reactor program, and as a bridgehead for Project Ice Worm, which was intended to shelter some 600 intercontinental ballistic missiles in tunnels under the ice. But while it served a very definite military purpose, it was presented to the public both in the US and in Denmark as a purely scientific research facility.

Not only does Camp Century present a fascinating story, but HENRY NIELSEN and KRISTIAN H. NIELSEN argue that it demonstrates the compromises that Denmark had to make as it tried to enforce its sovereignty in Greenland as the US militarized it. Although the US was powerful enough to execute the project, Danish resistance to nuclear weapons contributed to the demise of Project Iceworm. Camp Century presents an important example of how military-driven science may be a cover for military activities. Furthermore, the project provides an example in which the Government of Denmark tried to contain media coverage of US military activities in Greenland. Indeed, Denmark’s negative perceptions of US military activities combined with the tunnels being no match for moving ice contributed to the project’s termination.
The Arctic was a constrained space for research during the Cold War, as international collaborative scientific projects in Greenland and other Arctic lands were subject to strict political regulation. Although Danish scientists had played key roles during the second International Polar Year (1932/33) and Greenland had been the site of many its activities, by the time of the International Geophysical Year (1957/58), Greenland had been marginalized as a research space and Danish scientists played a limited role in the international organization.

In examining the two distinct views of Arctic research in the 1960s—that of Denmark and the United States—HENRIK KNUDSEN discusses the political and geostrategic factors that shaped and limited international research activities in Greenland, arguing that while there was a 1964 attempt to create test stations in the Arctic, it received no support from US interests due to the defense posture in the Arctic. Indeed, it appeared that creating an agreement similar to the Antarctic Treaty might allow détente-loving Scandinavians to invite Soviet researchers into this contested space. Actually, this was exactly what the Government of Denmark did on one hand, while at the same time banning US projects it feared could potentially harm the international process of détente.
Danish scientists became aware of potential interest in Greenland’s uranium deposits immediately after World War II, but the Danish government hoped that the early exploratory expeditions would not find significant deposits so as to avoid the attention of the United States and the Soviet Union - attention seen from Copenhagen as a threat to security and Danish sovereignty. However, by the mid-1950s, Danish interest in uranium increased as the prospect for energy independence spawned a nuclear research program with the aim to develop a Danish heavy-water reactor, fueled by uranium from Greenland.

HENRY NIELSEN and HENRIK KNUDSEN explore how two separate efforts to capitalize on Greenlandic uranium deposits failed. The early one noted above, because of the difficulty in extracting the uranium in combination with the breakdown of the Danish nuclear reactor development project in the 1960s. A second one, starting in the 1970s, mainly failed due to political and environmental opposition to nuclear power both in Denmark and Greenland. Opposition in Greenland dovetailed with demands for home-rule, which became a considerable political factor at the same time as US interests and activities in Greenland sharply declined. This still developing story has implications today for Greenlandic self-rule and the exploitation of uranium and rare earth minerals that could enable economic and political separation.
Selected Publications


FORTHCOMING EDITED BOOK