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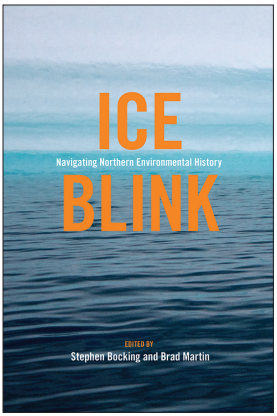

ICE BLINK: NAVIGATING NORTHERN ENVIRONMENTAL HISTORY Edited by Stephen Bocking and Brad Martin

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Western Electric Turns North: Technicians and the Transformation of the Cold War Arctic

Matthew Farish and P. Whitney Lackenbauer

The October 1959 issue of the *Illinois Technograph*, a periodical produced out of the Civil Engineering Building at the University of Illinois Urbana-Champaign, was rife with advertisements for work in the American military-industrial complex: atomic technology at the Sandia National Laboratories in Albuquerque, New Mexico; fighter planes at Convair in Fort Worth, Texas; and missile systems at the Garrett Corporation and the Jet Propulsion Laboratory in Los Angeles and Pasadena, respectively. The presence of these and other recruiters was testament to the growing prominence of a "gunbelt" landscape spreading across the south and west of the United States.[1] The magazine also contained an ad for a corporation with prominent Illinois roots (Fig. 8.1). Opposite an image of that month's "Technocutie," Judy Stephenson, was the headline "ENGINEERS explore exciting frontiers at Western Electric." Below a photo of two glasses-and-tie-wearing "defense projects engineers" hard at work, the text began:

W.E. DEFENSE PROJECTS ENGINEERS are often faced with challenging assignments such as systems testing for the SAGE continental air defense network.

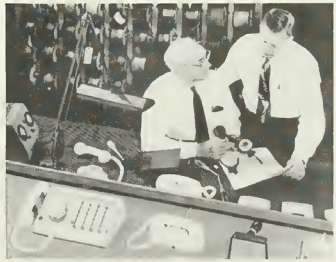
ENGINEERS explore exciting frontiers at Western Electric

If guided missiles, electronic switching systems and telephones of the future sound like exciting fields to you, a career at Western Electric may be just what you're after.

Western Electric handles *both* telephone work and defense assignments . . . and engineers are right in the thick of it. Defense projects include the Nike and Terrier guided missile systems . . . advanced air, sea and land radar . . . the SAGE continental air defense system . . . DEW Line and White Alice in the Arctic. These and other defense jobs offer wide-ranging opportunities for all kinds of engineers.

In our main job as manufacturing and supply unit of the Bell System, Western Electric engineers discover an even wider range of opportunity. Here they flourish in such new and growing fields as electronic switching, microwave radio relay, miniaturization. They engineer the installation of telephone central offices, plan the distribution of equipment and supplies . . . and enjoy, with their defense teammates, the rewards that spring from an engineering career with Western Electric.

Western Electric technical fields include mechanical, electrical, chemical, civil and industrial engineering, plus the physical sciences. For more detailed information pick up a copy of "Consider a Career at Western Electric" from your Placement Officer. Or write College Relations, Room 200D, Western Electric Company, 195 Broadway, New York 7, N. Y. And sign up for a Western Electric interview when the Bell System Interviewing Team visits your campus.



TELEPHONES OF THE FUTURE—Making telephone products for the Bell System calls for first-rate technical know-how. Tomorrow's telephone system will demand even more imaginative engineering.

Western Electric

MANUFACTURING AND SUPPLY UNIT OF THE BELL SYSTEM

Principal manufacturing locations at Chicago, Ill.; Kearny, N. J.; Baltimore, Md.; Indianapolis, Ind.; Allentown and Laureldale, Pa.; Burlington, Greensboro and Winston-Salem, N. C.; Buffalo, N. Y.; North Andover, Mass.; Lincoln and Omaha, Neb.; Kansas City, Mo.; Columbus, Ohio; Oklahoma City, Okla.; Teletype Corporation, Chicago, Ill. and Little Rock, Ark. Also Western Electric Distribution Centers in 32 cities and Installation headquarters in 16 cities. General headquarters: 195 Broadway, New York 7, N. Y.

OCTOBER, 1959 37

FIG. 8.1: Western Electric recruitment ad. *Illinois Technograph* 75, no. 1 (October 1959): 37.

> If guided missiles, electronic switching systems and telephones of the future sound like exciting fields to you, a career at Western Electric may be just what you're after. … Western Electric handles *both* telephone work and defense assignments … and engineers are right in the thick of it. Defense projects include the Nike and Terrier guided missile systems … advanced air, sea and land radar … the SAGE continental air defense system … DEW Line and White Alice in the Arctic. These and other defense jobs offer wide-ranging opportunities for all kinds of engineers.[2]

Western Electric, "the manufacturing and supply unit of the Bell Telephone System," recruited regularly in the *Technograph*.[3] In the December 1959 issue, its ad focused on the wonders of computer technology and promised "8,000 supervisory jobs" for engineers "in the next ten years," along with "corresponding opportunities for career building within research engineering."[4] In February 1960, beneath an extraterrestrial vista, the text suggested that Western Electric employees "may engineer installations, plan distribution of equipment and supplies," or join a growing group of field engineers "whose world-wide assignments call for working with equipment we make for the Government."[5]

This chapter is concerned with one set of installations that had recently been engineered by Western Electric employees sent out on those worldwide assignments, namely the radar stations established across Canada's arctic reaches in the early years of the Cold War. As the *Technograph* advertisement indicated, Western Electric had "handled" the Distant Early Warning (DEW) Line, which the company—with the help of Pentagon partners, almost three thousand sub-contractors, and a host of geologists, oceanographers, meteorologists, and other scientists—built from Alaska to Iceland in the 1950s and early 1960s.[6] The prospect of a high-arctic radar network that could detect hostile bombers, a project US Air Force officials had dismissed as excessively expensive and technologically dubious when it was first contemplated in 1946, received presidential approval in the aftermath of the Soviet detonation of a hydrogen bomb in 1953. The United States paid for and established the radar chain across the seventieth parallel, three-quarters of which was in Canada; a formal agreement

on the matter was settled by the two states in November 1954. The DEW Line was completed by 1957, its creation an extraordinary feat of "geographical engineering" that altered the military, logistical, environmental, and social characteristics of the North American Arctic.[7]

The consequences of these endeavours have recently achieved notoriety in Canada. Over the last two decades, the remnants of the DEW Line have been targeted by a massive, $500 million effort, undertaken by contractors and northern residents, to remove debris and decontaminate sites rife with toxic waste.[8] Our focus here is on the conception, siting, and initial construction of the Line, and expressly on the roles played by Western Electric technicians—to borrow a useful term from the period—in the Canadian and Alaskan north during an era of dramatic arctic militarization.[9] One announcement in *Life* listed the corporation's duties as "development, design, engineering, procurement, transportation, construction, installation, testing and training of operating personnel."[10] It also participated in the broader northern extension of the state discussed more fully in Tina Loo's chapter in this volume—or in this case, *two* states, whose arctic ambitions were markedly similar when it came to defence.

Crafting a set of enduring military structures resulted in, and was also premised on, a fundamental reconfiguration of arctic environments. This reconfiguration was focused on the dozens of DEW Line sites, but it ultimately represented a systematic alteration of the "southern" human presence on northern sea and soil. The consequences for Indigenous northerners, who received minimal attention from the DEW Line's designers, were profound. While particular substances and stories undoubtedly remain elusive or under-discussed, evidence of the Line's impact on land and northern lives is now reasonably well documented across an eclectic group of remediation reports, media accounts, and community-based oral histories produced over the last two decades.[11]

We are interested in and indebted to these sources, and along with our own archival and field-based research, they are central components of a broader study that is in progress. In focusing on a largely unknown and understudied group of workers, however, this chapter situates their physical labour alongside an equally significant imaginative revaluation of arctic geography.[12] While variants of the "idea of north" are common tropes in Canadian scholarship on the Arctic, these studies have remained largely separate from regional or community histories—or, for that matter,

histories drawing connections between such sites and places ostensibly beyond "the north." The case of Western Electric technicians is instructive precisely because it renders these spatial separations impossible. How the "handlers" of the DEW Line *approached* the north—how they were trained to understand it, how they saw and described it, in both distant and more grounded ways—was inextricable from their numerous northern activities during a brief period when extraordinary power was bestowed upon and exercised by their employer. As Edward Jones-Imhotep puts it in a rare discussion of northern technicians after the Second World War—specifically, employees of Canada's Radio Physics Laboratory who travelled to Churchill, Manitoba, to study auroral displays—"visions of a remote and isolated" region "were in fact underwritten by the assertions of science."[13]

Western Electric's promotional films and publications frequently treated the terrain of the DEW Line as wilderness or wasteland replete with "harsh and unrelenting disciplines," and this narrative would certainly have influenced the company's employees, who faced an "imposing array of problems" on their northern assignments.[14] Such unsurprising characterizations, hardly limited to the DEW Line case, have been both durable and consequential. According to a leader of the recent Canadian remediation effort, "It was remote, hardly anyone lived there, these sites were in the middle of nowhere far from anyone's imagination and therefore the environment wasn't at the fore."[15] But this sort of historical and geographical distancing should be treated with scepticism. After all, the "mysterious north" was a realm of tremendous cultural and political significance in North America during the 1950s.[16] Equally, as Andrew Stuhl and others in this volume document, the role of the Canadian Arctic as a target for combined state and scientific experimentation was certainly not new after the Second World War. While the dimensions of the DEW Line were unprecedented, a consistent historiographical point remains: even as the Arctic was and still is frequently treated as a distinct social or environmental region, it is imperative that scholars challenge such exercises in strict boundary-making.[17]

It is precisely for these reasons that the histories of concern, here, are not exclusively "northern"; nor is the north itself particularly easy to fix in the genealogy of something as simultaneously monumental and dispersed as the DEW Line. This story must extend beyond radar stations

and adjacent communities to a sprawling set of bases, boardrooms, field sites, and laboratories—and to the pages of periodicals such as the *Technograph*. In these locations, powerful forms of environmental knowledge, along with elements of the Line itself, were being generated, debated, and tested. To speak of the Cold War transformation of the north, then, means blurring the materiality of places with their discursive counterparts, and requires movement across a range of scales and relationships.

In the next section of the chapter, we introduce two terms, *high modernism* and *technopolitics*, which help to locate the DEW Line both conceptually and historically. A project of tremendous physical and symbolic scope, the Line was consistently treated by its champions as an unprecedented and masterful achievement in the long human struggle with a forbidding northern nature. Building on related scholarship in environmental history, historical geography, and the history of science, we suggest that such epic assertions were made possible by the more focused efforts of engineers, planners, and related workers, who established and maintained the conduits between site-specific and more indiscriminate knowledge of arctic geography. This role, and the authority granted to it, allowed the Line, and "the north" as a whole, to be treated in technical terms—as a space for the receipt of devices and practices perfected in a laboratory setting. How this came to be, and who these northern technicians were, are interesting questions, and we address them in the middle of the chapter. But they must be placed alongside two additional queries: what was missing from this technical vision of the north, and what were its limits? Given that the DEW Line was a military initiative, and given that its consequences for the north continue to be discussed and experienced today, these latter questions are particularly acute, and we turn to them in the final pages.

High Modernism, Technopolitics, and "Industry's Defense Mission" in the North

Frequently characterized as one of the largest and most challenging engineering initiatives in human history, the DEW Line—"so spectacular, so awe-inspiring, so nature-defying in concept"—was a paradigmatic example of a high modernist megaproject.[18] If its military value was

debatable, the Canadian observer C. J. Marshall wrote in 1957, "there is no doubt" that the Line was "a dramatic engineering achievement; and because of it, life in the Canadian Arctic will never be the same again."[19] In the wake of James C. Scott's influential book *Seeing Like a State* (1998), scholars from a variety of disciplines have documented and debated the global history of high modernism, or what Scott defines as "a sweeping, rational engineering of all aspects of social life in order to improve the human condition." This concern for social improvement was paired with a "belief that it was man's destiny to tame nature to suit his interests and preserve his safety."[20] Neither of these imperatives was new in the first decade of the Cold War, but the planetary extent of that conflict, the gathering power of multiple military-industrial complexes, and the particular conflation of technoscience and geopolitics spawned by the Manhattan Project all contributed to the belief that a megaproject such as the DEW Line was both attainable and necessary.

DEW Line planners were far more concerned with the "safety" of a threatened North American industrial heartland than they were interested in the sites that would be dramatically altered by the arrival of the Line. Similarly, the taming of *northern* nature, however challenging, was only a late stage in a series of governmental moves that fused science and security during the 1940s and 1950s. Dreamed and designed in laboratories described by their patrons as contributors to the "field of safety engineering," the Line was a mere component—if a significant one—of a massive new defence network treated as a manageable system precisely because this terminology countered the profound uncertainty of the Cold War.[21]

In James Scott's wake, environmental historians and geographers have provided nuanced accounts of widespread landscape transformations proposed and conducted in the spirit of high modernism, from nuclear testing to the building of large dams.[22] In one exemplary study of the latter, Tina Loo and Meg Stanley note that high modernism was characterized by a particular "way of seeing," a "synoptic" view that treated territory schematically, without the messy details of "biophysical and social contexts."[23] This way of seeing is also a symptom of a depoliticized, administrative treatment of geography.[24] The "success" of a megaproject depended on the combination of such abstracted hubris with a more practical form of knowledge about places and people. Yet it would be a mistake to oppose these two modes of understanding. Following historians

of science, who have argued persuasively that all science is marked, in Steven Shapin's words, by the "spatial circumstances of its making," Loo and Stanley argue instead for what they call "high modernist local knowledge," found most prominently in the agents who designed and built large dams. These workers were distinct from Scott's detached protagonists. Engineering studies generated quite intimate information about dam sites, in the process making those environments "legible," ready for reconfiguration.[25] Such reports might be considered "the engines of change" for high modernism—alongside the relatively obscure figures who prepared them and set them in motion.[26]

This framework is well suited to understanding Western Electric's DEW Line role. But the admirable search for a more contextual history of high modernism must also consider the traffic between multiple sites of knowledge production—and, as Marionne Cronin reminds us in her chapter in this volume, the irrevocable entanglements of technologies and environments. In addition, there are, in our account, many intersecting variants of "the local," and Emilie Cameron's chapter encourages careful consideration of that term's uses and limits. Moreover, the DEW Line was a distinctive type of high modernist endeavour: it was treated as a technical solution to a military dilemma, and as such represented the dual mid-century "optimism in both technology and state authority," a faith channelled into the Cold War competition for the dominance of terrestrial and extra-terrestrial space.[27] Unlike many of the high modernist examples introduced by Scott, the DEW Line was not an explicitly social project. Its proponents and producers devoted a tiny fraction of their energy to the consequences of radar construction for northern residents. Even so, as a new communications network, a demonstration of apparent environmental mastery, a source of wage income for certain northerners, a repository of southern expertise and cultural practices in the Arctic, and a "shield" built to secure North American "social life" (in Scott's words), the Line was irrefutably an exercise in *modernization*.[28]

If Western Electric engineers were building "installations" and planning "distributions" of equipment, by the 1950s it made particular sense that these were military installations and items. The practice of calling on "the resources and know-how of the large communication companies to act as prime contractors in planning and supervising" defence projects, according to one AT&T executive in a 1958 speech, was to be celebrated

as "The American Method."[29] In the midst of Western Electric's DEW Line responsibilities, an in-house magazine article on the topic referred straightforwardly to "Industry's Defense Mission."[30] As Shapin notes drily, "Big Science had remarkably few apologists, just because it had so little *need* of apologetic defense."[31] By the end of the 1950s, there were some eighteen thousand Western Electric employees engaged exclusively in defence work.[32] But *how* they participated in their "world-wide assignments" is a more complicated matter.[33]

During the Second World War, "Army ground and air forces, Navy ships, submarines, and planes, and Marine landing forces" were all using Western Electric-built radars.[34] Similar collaborative "Big Science" was underway at MIT's Radiation Laboratory (Rad Lab), and of course in the various facilities of the Manhattan Project. Elements of both, including some individuals, soon migrated into MIT's Lincoln Laboratory, the crucial interdisciplinary site for research on Cold War continental defence. One historian of science describes all of this effort as defined not just by accomplishments, or magnitude, but by the "efficient integration of emerging technologies into goal-directed systems, along with the organizational arrangements" that accompanied these systems.[35] Fabricating durable radar networks, as S. P. Schwartz of Western Electric put it, was ultimately a question of "the capability of man and equipment to function" together.[36]

To speak in the language of goals, functions, and human-machine hybrids is to deploy the vocabulary of *technopolitics*. The creation of the North American continental defence network, with the DEW Line along one edge, involved what Gabrielle Hecht describes as "the displacement of power onto technical things."[37] Technopolitics, for Timothy Mitchell, is "a particular form of manufacturing … so that the human, the intellectual, the realm of intentions and ideas seems to come first and to control and organize the non-human."[38] The influence of this arrangement was certainly on display in the North American Arctic after the Second World War, an era of far-reaching, state-driven social experiments, some of which blended human development aims with infrastructural initiatives.[39] Nevertheless, as Mitchell notes, "the intentional or the human is always somewhat overrun by the unintended," and this maxim is a reminder of technology's powerful instability and a useful check on the triumphant narratives of military modernization found in period newsreels, print journalism, industry reports, government documents, and even academic sources.[40]

As such, we should carefully consider how continental defence technology was designed or used "to enact political goals," but also how the material of the DEW Line—as it was conceived and put in place—led to unpredictable results.[41] The crucial hinge is the relationship between the expert "perfection" of radar devices at locations like the Lincoln Laboratory and their subsequent conversion into "field-ready combat tools, capable of being operated by military personnel with only limited scientific training."[42] More than any other agency, it was Western Electric that managed this conversion from laboratory to field.

To embark on this task did not mean completely leaving the laboratory milieu behind. As Scott Kirsch notes, laboratories "have travelled … as methods; that is, as experimental technologies and epistemologies adapted to the field, but also, it should not be overlooked, as communities."[43] Much of the northern work carried out by Western Electric employees was premised on attempts to apply consistent, learned practices in a distinctly different environment. The north, as many visitors expressed both informally and directly, was itself a laboratory for science, engineering, and military exercises—statements that imply geographic distinction, but also a certain confidence of universality, backed by a clear political mission.[44]

In the newsreel language of the period, a "grim and forbidding Arctic waste" or "barren frozen wilderness," "where man must learn to live with nature before he can defend himself against a living enemy," might challenge the capabilities of technopolitics, but for Western Electric and its boosters, the "frigid latitudes" certainly did not overturn them. The "test of men and machines" was just that—an opportunity to further the reach of a technopolitical worldview.[45] The result, another film boasted, was that a "3000-mile long strip … began to lose its timeless identity and take on its new identity: DEW Line."[46]

Techne, Technicians, and Training

As radar stations and other military installations were constructed across the north in the 1950s, they emerged as part of a particular *techne*, or what Michel Foucault called "a practical rationality governed by a conscious goal"; they were produced by a combination of art and artifice, creativity and labour.[47] In the familiar tones of one archival account, Western

Electric's many DEW Line responsibilities are followed by results: "Special buildings and construction techniques were devised to withstand severe arctic weather. Stations were exhaustively evaluated, designs were modified, equipments were changed to combat polar magnetism, effects of constant wind and cold were measured—*both on men and the complex devices they would have to keep operable*."[48] The production of the Line—its bringing-forth—was thus done with and by such men (and the masculine, or more precisely a particular variant of masculinity, is significant here). They had been trained in these special techniques of representation, calculation, development, and maintenance. Such consistent and yet flexible practices were more generally being put to use by teams of workers across the facilities of the growing military-industrial complex.[49]

"Technician" had been on the lips of many North American educators and scientific advisors since the Second World War. The word's meaning in English as a "person skilled in the mechanical arts" apparently dates from 1939. In an influential 1945 paper, the American geographer Edward Ackerman grappled with the extraordinary "data for wartime research" generated in agencies like the team-driven Office of Strategic Services, where he had worked. This data covered such a "wide range of subjects" that it required the skills of new "systematic specialists." Ackerman's words were prophetic: these specialists turned out to be the high-profile "experts" who led post-war area studies institutes, or who headed interdisciplinary teams devoted to the problems of continental defense. Meanwhile, Ackerman suggested, those "technicians" whose skill with detail was offset by poor interpretative abilities should, like laboratory employees in physics or biology, be put to use on "mechanical work of the mind and eye."[50] While Ackerman had geographers and cartographers in mind, similar changes were unfolding in other fields—a sharper, more vertical version of an older and very gendered division of labour, perhaps, but also the recognition that both "specialists" and "technicians" were necessary to understand, to diagnose, a complex, interrelated post-war globe.[51] Ackerman's conundrum was epistemological, but it was also one (to borrow from his article's title) of "Geographic Training" and "Professional Objectives."

In his essays on American physics and physicists after the Second World War, David Kaiser notes the importance granted to the production of new scientific workers during a period of dramatic increases in funding for the sciences. A disproportionate amount of this spending arrived from

the Pentagon and related branches of the federal government.[52] These dollars paid for instruments and equipment, but also for education itself.[53] The equation of national security with science was backed by a "Cold War logic of wartime requisitions" and repeated references to scientific *manpower*.[54] This discourse bubbled along steadily through the late 1940s and 1950s, and grew more urgent after the Soviet launch of Sputnik I in October 1957. The context for the *Technograph* advertisement and similar notices was thus a furious drive to produce engineers for Cold War work.

Only some of these physicists and engineers were destined for academic careers; most found their way to well compensated positions at both national and corporate laboratories.[55] Most of the Western Electric advertisements in the *Technograph* concluded with a pledge to fund a reader's graduate education in engineering. As these readers probably recognized, and as historians of science have shown, any prestige and authority granted Western Electric employees was not the same as that ascribed to the caricatured individual academic scientist; instead, it was firmly rooted in the rewards of a job with a prominent industrial firm that served the state, the nation, and corporate capitalism all at once.[56] The Bell System's "most valuable resource," a Western Electric executive wrote in a 1956 discussion of the DEW Line, was "trained manpower." When it came to northern work, however, Western Electric technicians required an extra set of lessons pertaining to life in an environment understood as markedly different from their "peaceful state-side towns."[57]

The Laboratory in the (Corn) Field

The extension of the laboratory into the field, in a world "of testing and simulation, experiments and proving grounds," was a critical concern for students of arctic engineering and arctic warfare during the early Cold War.[58] For Western Electric, this concern was addressed in the middle of an actual field: a swath of corn five miles from the town of Streator, Illinois, about 160 kilometres southwest of Chicago.

In 1952, fresh with instructions from the military, Western Electric employees arrived in the cornfield to erect a prototype radar facility, an "inflated 55-foot hemisphere," which was operational by the following year.[59] The company "provided overall management of the planning,

design, and construction" of the Illinois "pilot plant," which was built to "ensure smooth and efficient operation when the actual DEW Line construction was undertaken."[60] In Illinois, and at a three-station "test line" also set up in 1953 by Western Electric along the Beaufort Sea between Barter Island, Alaska, and a Canadian location just east of the Alaska border, attacks were simulated using a variety of military and civilian aircraft, along with the insertion of "artificial data" into a rudimentary tracking system.[61] The arctic sites were established to test "DEW Line-like operations … under arctic conditions," while the Streator location "served as both a proving ground for testing experimental prototype equipment, and as a training area for personnel."[62] But it was not clear—in Illinois, on the Beaufort coast, or on the finished Line—where the laboratory ended and the field began. Were the lines drawn back at MIT's Lincoln Laboratory, at the New York headquarters of Western Electric, inside a radar station, at the southern borders of the amorphous region known as the "Arctic," or at the edge of a cybernetic continent? After all, as one *Western Electric Engineer* article put it, the company's technicians shared a "common objective," identifiable in an "esprit de corps … which touched alike the surveyor in the field who was trying to keep his eyelid from freezing to his transit and the engineer working late into the night in a New York office." Was this objective the defence of North America from Soviet attack, or was it the pursuit of "inspired engineering" in the face of "an uncooperative Nature"?[63] The two were not necessarily identical.

Hired by Western Electric in 1953, the Canadian radar engineer William Barrie recalled meeting with a team of psychologists from Northwestern University, who subjected him and other recruits to aptitude tests, questions about solitude and survival, and political conversation (this was the McCarthy era, after all). One Bell System publication described this "processing" by stating that "any of the men would confirm that the armed forces never gave a physical any stiffer than the one they had to pass—in addition to a psychological test to insure their successful coping with rigorous living and isolation."[64] Having passed, Barrie was sent north to Barter Island to "calibrate and evaluate" the equipment of the test line. Instructions and questions arrived daily via teletype from New York City, from Bell Labs, and from other Western Electric plants. Security was so severe that he was "prevented access to my own test results." But he "had

all the amenities of an isolated US military base," including a model railroad and a darkroom.[65]

The Cold War itself was being staged as a series of experiments. In the Illinois cornfield, these were managed by the Western Electric (and later Federal Electric) technicians who were "transported to and from the site each day in a blue military bus with US Air Force markings."[66] Meanwhile, at a Bell Labs site in Whippany, New Jersey, a full "DEW Line Radome" was built to "eliminate the need for many trips to the Arctic by engineers."[67] Even so, this experimental use of new radar technology for testing and training was also changing and circumscribing the arctic environment in important ways.[68] The nuances of northern nature were undoubtedly important for the DEW Line's builders, but only in a secondary sense—as hindrances to be overcome or held at a remove from the technical devices placed in the north for reasons of military exigency.

Siting the Stations

The Streator testing and training centre and the western arctic test sites were vital parts of Western Electric's Project 572, the code name for the preliminary and secretive surveying, planning, and experimental work conducted from late 1952 to 1955 that led directly to the construction of the DEW Line.[69] According to one account, it was "a problem of logistics to the *n*th degree," requiring the creation of an entirely new "organization."[70] By early 1953, a "siting engineers" group had been created to oversee the experimental locations and to recommend a suitable route for the future full DEW Line. The qualifications for membership on the small crews dispatched by this group to the Arctic were precise: unmarried male Bell System engineers under thirty-five years old who were war veterans, outdoor enthusiasts, familiar with radio and radar technology, and of the appropriate "disposition" for long hours of labour in a challenging milieu.[71] While these teams "lived and worked under the most primitive conditions," they nonetheless approached their duties, and the north itself, with "scientific means."[72]

Meanwhile, the core cluster of siting engineers began to collect geographic knowledge on the Arctic—knowledge that combined high modernist visualization with grounded nuance. While prior surveys

and military construction projects had produced a wealth of usable information for the north coast of Alaska, a "similar review of the available data of Arctic Canada did not meet with as much success." Western Electric proceeded to bombard branches of the Canadian government for additional detail, but much of it was deemed inadequate. The exception was the trove of aerial photographs—many of them trimetrogon prints suitable for cartographic use—held at the Royal Canadian Air Force's 22 Photo Wing Headquarters in Rockville, Quebec.[73] These were new images, produced since the end of the Second World War, when northern Canada had become "the major part of the photographic survey program."[74] The resulting synoptic views of arctic space—turned into similarly influential topographic maps—were emblematic of the rich, entangled relationship between aviation, science, governance, and militarization in the post-war north.[75] Although the RCAF's photographs were considered "excellent," and were used (along with soil reports and other environmental studies) to prepare "paper layouts" of stations before actual construction began, at this early stage the images were *too distant* for Western Electric and contained inadequate environmental detail. They were therefore combined with "low-level aerial reconnaissance, and on-the-ground inspections" in the summer of 1953.[76] All of these approaches to arctic geography prioritized "strategic location and topography," fitting individual locations into a logistical network of supply and operations.[77]

In addition to tests of communications and radar devices, Western Electric also experimented with forms of shelter along its western arctic test line in Alaska. The best result, according to an official history, "was the 'module' unit," a flat-roofed building made from panels of prefabricated plywood. Placed together and set on pilings that were driven into the permafrost, these modules formed "trains" that were suitably enclosed and separated from an external environment.[78] Such structures were modest but influential additions to northern architecture in the period after the Second World War, sitting alongside the more dramatic DEW Line radome, also designed precisely to contain its mechanical organs from a hostile exterior. In the 1950s, few structures were more redolent of "industry's power to transform nature" than the radome, but the accompanying "train" was also a hallmark of military modernization in the north (Fig. 8.2).[79]

Fig. 8.2: DEW Line site POW-M, Barrow, Alaska, December 1962. David E. Chesmore Photo Collections, Archives, University of Alaska-Fairbanks, Alaska and Polar Regions Collection, Item 2004-0171-00163). Reprinted with permission.

All of this effort—not to mention many conversations with Arctic "experts" and an extensive literature review—was funnelled into the centre of calculation that was Western Electric's New York City corporate headquarters.[80] By October 1953, it had prepared a "consolidated report" for the US Air Force, asserting that "a feasible route exists for construction of a distant early warning line using … methods and techniques as now proposed by Western Electric Company."[81] Receiving this and other documents, the recently formed bi-national Military Study Group (MSG) of strategists "could not escape the conclusion," according to a June 1954 memorandum, "that there was a need for the establishment of the Canadian Arctic segment of the distant early warning line … a start should be made at once."[82] Similar technical studies were discussed at the October 1954 meeting of the Permanent Joint Board of Defence, where American participants used Western Electric material to confirm that "the necessary data to start work on the sites during the 1955 construction season [is]

available."[83] The following month, Western Electric collaborated with a spin-off of the MSG, a Locations Study Group, to settle on a route for the Line, with its eastern end at Baffin Island's Cape Dyer rather than further south at Resolution Island. By the end of 1954, Western Electric had secured the full contract for the DEW Line. "Consummated" in July 1955, it was a "package plan" based on a "cost, plus fixed fee" arrangement, which ranged from design to testing, with a completion date set for mid-1957.[84]

Western Electric had already created a "siting manual" for additional, more place-specific operations across the Arctic in 1955. With the help of Canadian and American aerial photography, surveying, and engineering firms, it quickly prepared detailed location reports for each future station. These texts relied on a variety of confident forms of geographic description and visualization. Each one included a section titled "Acquisition of Lands," and this was tellingly a process rendered in strictly technical and contemporary terms.[85] While Western Electric established a DEW Line Project Office in New York City, contractors quickly finished all of the siting work in Canada, and moved on, in the second half of 1955, to the Alaskan locations.[86]

"Conquered by Degrees"

When Western Electric received the contract to build the DEW Line, one promotional film portrayed the project as a "weapon system."[87] Months later, in one of the first media accounts of the initiative, journalist Leslie Roberts described it as "the first mass assault on the Arctic."[88] Despite the clear defence imperatives and the accompanying propensity for martial terminology, however, the DEW Line's military purpose was simultaneously complemented and superseded by another discourse in the popular press, corporate journals, and government literature: the Line was merely a matter of "technical feasibility," and the targets of "assault" were northern landscapes.[89] According to a typical account in *North*, the bi-monthly magazine produced by Canada's Department of Northern Affairs and National Resources, "trials and related work" revealed that "the practical DEW Line could be built across the Arctic, despite rigorous climatic conditions and difficult supply routes."[90] With construction nearly completed in the spring of 1957, "over 1,000,000 tests were performed to prove

out the system to Western Electric's satisfaction."[91] The DEW Line was consistently presented as a logistical matter of overcoming environmental challenges. If political questions entered into this description, they had either been settled beforehand or were simply negated by the realization of technical success.

If success was defined in technical terms, it was nonetheless *made* in improvisational, intimate, and even awkward ways. One Western Electric history suggested that "the biggest threat to the project did not come from the Soviets, but from the forbidding Arctic weather," and described workers wearing "30 pounds of clothing" and awkwardly carrying bulky sleeping bags "whenever going out for a stroll."[92] C. J. Marshall recalled "watching the weary and disgruntled members of a pioneer construction crew laboriously moving their tents, supplies and equipment across the five miles which separated their camp from the site eventually chosen for the station." In such accounts of bringing-forth, stories of "miscalculations made under the pressure of the moment"—and eventually corrected—are legion.[93]

Unsurprisingly, many Bell System publications featured a more triumphant rendering, employing intriguing phrases and figures.[94] Western Electric's slim volume *The DEW Line Story*, distributed in 1958 to members of "the Bell System team responsible for the planning and construction of this history-making project," arrived with an accompanying letter from William Burke, the company's Vice-President for Defense Projects. His gracious note of thanks also nodded to a clandestine, affective affinity: "Only those who have been intimately associated with the project," Burke wrote, "can know the full extent of the difficulties our people overcame, the hardships they endured and the intense effort they applied."[95] *The DEW Line Story* bolstered this sense of environmental adversity, but it also tabulated unprecedented arrivals from the south in the north. "*460,000 tons* of materials were moved from the U.S. and Canada to the Arctic by air, land, and water," the commemorative book exclaimed, as if the terminus was a distinct continent (Fig. 8.3).[96]

Even as it characterized the "north" as a destination *for* labour and material, *The DEW Line Story* stitched arctic places into a continental network whose extraordinary complexity was statistically signalled: 113,000 purchase orders, 818,000 oil drums, 45,000 commercial flights, 22,000 tons of food, and so on.[97] Such tabulation, drawn directly from Western

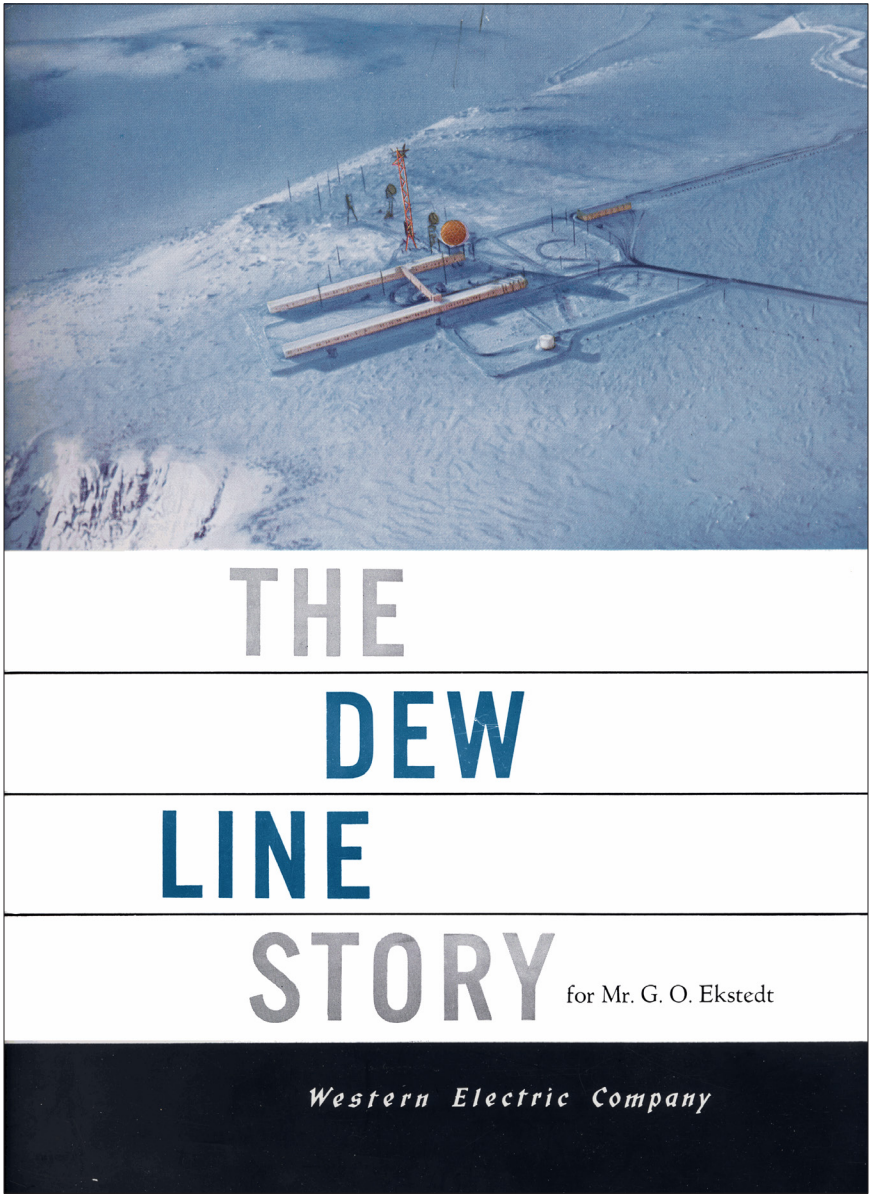


Fig. 8.3: Cover of *The Dew Line Story* (New York: Western Electric Company, 1958).

Electric's reports to the military, suggested smooth progress, an operation of enormous scale, and a northern realm bereft of modern artifacts.[98] All of these elements were amalgamated with the aid of a new "military technology": the science of logistics. It allowed the Arctic to be "conquered by degrees," ruled ultimately by a generic, dispassionate DEW Line station, with its "one eye" and radio "ears" and "voice." This cybernetic entity, the publication implied, was barely northern: it was made and maintained by southern workers with southern tools and intelligence. As if to illustrate this principle, an image in *The DEW Line Story* shows "a pair of Eskimos" ice-fishing "in the shadow" of a generic, forbidding radome.[99]

Writing for a corporate audience in *Bell Telephone Magazine*, William Burke captured the technopolitical version of the Line. "Only through the skill, the scientific knowledge, the superlative mechanical equipment which the latter half of the twentieth century have made available, and the teamwork of many military and civilian agencies of both the United States and Canada, could so stupendous a project be accomplished at all," he boasted.[100] Burke's prose melded human and machine, military and civilian, and American and Canadian to *complete* a "project" whose geographic location was less important than what history had passively "made available." Yet it was ultimately "up on the DEW Line" that all of these factors came together to form a "single, closely integrated team, welded together by the sense of the urgency of the job."[101] For all of the hyperbole and the language of accomplishment, the Cold War Arctic and its identity as a proving ground for military experimentation were never far from view.

The Limits of the Technical Arctic

Western Electric's approach to the DEW Line combined dominance over non-human nature with a displacement of military and corporate power onto radar devices and the equally technical work of erecting and maintain them.[102] Northern communities and the Canadian government are still reckoning with land around DEW sites that was treated "like a vast garbage dump." Photographs of vast numbers of bags filled with contaminated soil, waiting to be removed from Nunavut's Cape Dyer (the location of the DYE-MAIN station) in the summer of 2012, serve as a dramatic

reminder of high modernism's deleterious legacies.[103] It is too simplistic to ascribe this recklessness to the "remoteness" of the north without first understanding how such distancing was manufactured, not just from a southern location such as Streator, but in northern locations, as well. Alongside the detailed and yet disconnected site reports, or the consistent language of conquest, popular documentation on Western Electric's DEW Line efforts placed Indigenous northerners precariously at the edges or completely outside of the technical geography of the Arctic. They are strikingly absent from many of the studies that prepared the ground for the implementation of the Line's infrastructure. At best, Indigenous people are treated as a "small, but valuable reservoir of labor which is acclimated to the Arctic Zone," "baffled at first by modern machines and construction methods … [but] quick to catch on."[104]

The social and cultural context into which Western Electric employees entered was deliberately conditioned by southern expectations and experiences. To limit isolation and improve comfort, new arrivals to DEW Line stations received copies of military manuals on "polar operations"—handbooks that drew extensively from the conclusions of recent military exercises, and, in tellingly circumscribed and anecdotal ways, from a certain form of local knowledge.[105] A 1954 *Western Electric Magazine* article cheerfully titled "Next Door to S. Claus" noted that "W.E. Arctic dwellers … benefit from the experiences of the Armed Forces … to say nothing of the Eskimos who know from practical, if not scientific, experience, how to dress properly in the cold."[106] Reflecting a common (if crude) view shared by some Canadian northern administrators, C. J. Marshall contrasted the "precarious existence of the hunter and trapper" with the "life of routine and financial security" on the Line.[107]

While many of the Arctic's Indigenous communities were undoubtedly altered by the "routines" of Western Electric's technopolitical exercise, this process was not one of unidirectional assimilation. Project 572 arrived on Barter Island, in the northeast corner of Alaska, in the winter of 1952–53, and quickly moved east across the Canadian border. This was a startling development for the Inuvialuit people of the area. As David Neufeld writes, with a nod to oral histories conducted on the Yukon's North Slope, "The lack of local consultation and the consequent failure to attend to issues of local importance affected people deeply." Still, the proximity to DEW Line construction meant that complicated "social and

economic connections developed." Many families eventually congregated close to DEW Line sites, where one member (the adult male) might gain work, and where other informal relationships were forged. In sum, according to Neufeld, "The project initiated a host of changes in Inuvialuit lifestyle and activities," and other government and corporate initiatives across the North American Arctic paralleled Western Electric's arrival. The Canadian government recruited and sent Northern Service Officers northward to manage relationships between Indigenous residents and new arrivals. For all of their individual efforts, the NSO position came with a paradoxical combination of patronization and powerlessness in the face of larger environmental and social changes.[108]

At Cambridge Bay in the central Arctic, where a large DEW Line station (CAM-MAIN) was under construction in 1956, the young social scientist J. D. Ferguson, on assignment for the Canadian government's Northern Research Coordination Centre, perceived that the Inuit socio-economic hierarchy had been completely upended.[109] Residents were looking to the contractors building the station—who were distributing water, delivering mail and other items free of charge, offering casual employment, and offering their equipment to help with other construction—as the proximate "seat of authority," even as the general superintendent claimed that he did not want to get "mixed up" in community politics. (This person's professed interest, presumably, was only technical.) Although Ferguson invoked a familiar frontier motif to characterize what he witnessed, like a number of scholars travelling across the Arctic in the same period he could not check his concern with the damaging effects of "economic laissez-faire" and an "emphasis on individual enterprise at the expense of community."[110] His hope that the DEW Line would bring stability, once northerners had adjusted to its presence, was a rather lofty one. The result, instead, was a subset of Indigenous people who had received some training, but were not granted full-time, lasting work.[111]

Conclusion: "Electronic Outposts" on a Cold War Frontier

In an account of Hilton International Hotels and the building of the Cold War, Annabel Wharton shows how these monumental structures were explicitly positioned as symbols and repositories of American culture,

detached from but clearly intended to modernize foreign societies through the elites, national and foreign, who accessed and invested in such projects. As Conrad Hilton himself put it in his 1958 autobiography, "we, as a nation, must exercise our great strength and power for good against evil. If we really believe this, it is up to each of us, our organizations and our industries, to contribute to this objective with all the resources at our command."[112]

The comforts of the DEW Line facilities were not quite equivalent to those of Hilton's hotels. But radar sites were similarly representative of a normalizing culture—in domestic and community spaces, but also because it was "a thrill to fly from one side of the continent to the other and hardly be out of sight of friendly lights."[113] Alongside Conrad Hilton, we might consider H. G. Ross, the DEW Line project manager for Western Electric. The megaproject, Ross said on the occasion of the 1957 handover to the US Air Force, was a "full-scale attack on the Arctic unparalleled in military history," which "broke all the rules of the book and made a frontier which, for many years to come, will play a major role in keeping alive a way of life which makes the DEW Line worth every effort put into it."[114] This convoluted sentence captures the northward extension of the state, both geographically and historically. And the technicians who "built these electronic outposts in the unexplored Arctic" carried out much of this extension.[115] But when the universality of this technopolitical language, and the "way of life" that it conveniently secured, is placed in proper perspective, we are left with another set of uncertain, complicated, *lived* histories that are all the more consequential for their modesty.[116]

When planning the DEW Line project, military and corporate employees reimagined the Arctic as a functional realm, placing their unquestioned faith in the transformative powers of modern technology to reconfigure or simply overcome a "hostile" nature. To become part of the continental defence web, the Arctic was in one crucial sense rendered analogous to other locations—from laboratories in New Jersey to cornfields in Illinois. The result was that the north became a technical space upon which certain designs and assumptions were inscribed. Realizing these aspirations also required the production and transmission southward of details derived from arctic site visits, yielding new forms of usable geographical knowledge. And yet, as they transcended and blurred national, regional, and local scales, planners, engineers, logisticians, and

technicians also implicitly muddied the boundaries between north and south, as they devised and implemented practices that would overcome the particularities of climate and terrain. The DEW Line embodied the hubris of technopolitics and the assimilation of the remotest reaches of North America into a truly *continental* environment: one of military science and state control. This environment was not equivalent to "the Arctic"—however we define that term. Nor did it entirely supersede it. Our suggestion, instead, is that the two are indivisible.

Notes

1 Ann R. Markusen, et al., *The Rise of the Gunbelt: The Military Remapping of Industrial America* (New York: Oxford University Press, 1991).

2 *Illinois Technograph* 75, no. 1 (October 1959): 37 (original emphasis). See the similar advertisement in the *Wisconsin Alumnus* 60, no. 10 (February 1959): 36. In 1949, Western Electric was also asked to manage the Sandia Laboratory complex in New Mexico—the principal site for the development of American nuclear weapons after Second World War. Stephen B. Adams and Orville R. Butler, *Manufacturing the Future: A History of Western Electric* (Cambridge, UK: Cambridge University Press, 1999), 149.

3 "Contractor Chosen for Radar in Arctic," *New York Times*, 22 February 1955, 19.

4 *Illinois Technograph* 75, no. 3 (December 1959): 27.

5 *Illinois Technograph* 75, no. 5 (February 1960): 35.

6 The number is from "Western Electric: A Brief History," www.porticus.org/bell/doc/western_electric.doc (accessed 1 April 2011), 12. The bureaucratic history of the DEW Line is dizzying. Western Electric drew on multiple components from within the Bell System, including its Canadian affiliate, the Northern Electric Company, which at the time of construction was both separating from and still closely tied to AT&T. The major Canadian construction subcontractors were Northern Construction Ltd. and James W. Stewart Ltd., both in the west, and the Foundation Company of Canada, responsible for the eastern section of the Line. Once completed in 1957, the Line was staffed by yet another American military contractor, the Federal Electric Corporation. See *The DEW System* (Paramus, NJ: Federal Electric Corporation, n.d.).

7 On the Cold War origins of "geographical engineering," see Scott Kirsch, *Proving Grounds: Project Plowshare and the Unrealized Dream of Nuclear Earthmoving* (New Brunswick, NJ: Rutgers University Press, 2005).

8 For an example of news coverage, see "Northern DEW Line cleanup bill hits $500M," *CBC News*, 8 August 2011 (http://www.cbc.ca/news/technology/story/2011/08/08/north-dew-line-bases.html). The

clean-up project has been led by Defence Construction Canada, a Crown corporation whose sole client is the Department of National Defence. Ironically, the construction of the Line was often estimated to cost a similar amount—in 1950s American dollars.

9 For more on the physical transformations wrought by northern militarization, see P. Whitney Lackenbauer and Matthew Farish, "The Cold War on Canadian Soil: Militarizing a Northern Environment," *Environmental History* 12, no. 4 (2007): 921–50.

10 The advertisement, headlined "New Radar Sky-Watch to Guard Arctic Frontier," is in the 22 August 1955 issue of *Life* (p. 11).

11 In addition to the sources cited below, see collective histories such as *Inuit Recollections on the Military Presence in Iqaluit*, http://www.tradition-orale.ca/english/pdf/Inuit-Recollections-On-The-Military-Presence-In-Iqaluit-E.pdf (accessed 25 August 2012); *Paulatuuq Oral History Project: Inuvialuit Elders Share Their Stories* (Inuvik, NT: Parks Canada Western Field Unit, 2004); and Murielle I. Nagy, *Yukon North Slope Inuvialuit Oral History* (Whitehorse, Heritage Branch, Government of the Yukon, 1994). Also see individual oral histories, such as Abraham Okpik, *We Call it Survival: The Life Story of Abraham Okpik*, ed. Louis McComber (Iqaluit: Nunavut Arctic College, 2005); the work of Parks Canada's David Neufeld, such as "Commemorating the Cold War in Canada: Considering the DEW Line," *Public Historian* 20, no. 1 (1998): 9–19; and media accounts, such as Sandro Contenta, "DEW Line: Canada is cleaning up pollution caused by Cold War radar stations in the Arctic," *Toronto Star*, 4 August 2012, http://www.thestar.com/news/insight/article/1236806--dew-line-canada-is-cleaning-up-pollution-caused-by-cold-war-radar-stations-in-the-arctic.

12 See Derek Gregory, "Imaginative Geographies," *Progress in Human Geography* 19 (1995): 447–85.

13 Edward Jones-Imhotep, "Nature, Technology, and Nation," *Journal of Canadian Studies* 38, no. 3 (2004): 7.

14 The first quote is from M. S. Cheever and J. D. Brannian, "Building the DEW Line," *Engineering and Contract Record* 706 (1957): 80; the second is from C. J. Marshall, "North America's Distant Early Warning Line," *Geographical Magazine* 29, no. 12 (1957): 616–17. A different version of the wilderness motif was staged in Lois Crisler's *Arctic Wild* (New York: Harper and Brothers, 1958): "The DEW Line, obsolete while on paper, would keep rolling, wiping out wild habitat and animals in the biggest, best-armed invasion of this fragile life zone, the Arctic, ever performed" (64).

15 Dave Eagles, from Defence Construction Canada, quoted in the short film *Undoing the DEW* (Environment Canada, 2009).

16 Pierre Berton, *The Mysterious North* (New York: Knopf, 1956); Matthew Farish, *The Contours of America's Cold War* (Minneapolis: University of Minnesota Press, 2010), 173–89.

17 This point is made well in Robert McGhee, *The Last Imaginary Place: A Human History of the Arctic*

World (Chicago: University of Chicago Press, 2007).

18 Herbert O. Johansen, "World's Toughest Building Project," *Popular Science*, August 1956, 86.

19 Marshall, "North America's Distant Early Warning Line," 616–17. Marshall was listed as an officer in Canada's Department of Northern Affairs and Natural Resources who "represented Canada on the DEW Line Site Survey Team in 1955 and has since visited the line several times" (616).

20 James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998), 88, 94–95. For a more detailed discussion of high modernism in a northern context, including some of the limitations of Scott's formulation, see Matthew Farish and P. Whitney Lackenbauer, "High Modernism in the North: Planning Frobisher Bay and Inuvik," *Journal of Historical Geography* 35, no. 3 (2009): 517–44.

21 MIT President James Killian, quoted in "National Safety and the Universities," *Technology Review* 56, no. 7 (1954): 357; Farish, *The Contours of America's Cold War*, 153–54.

22 Important examples include Benjamin Forest and Patrick Forest, "Engineering the North American Waterscape: The High Modernist Mapping of Continental Water Transfer Projects," *Political Geography* 31 (2012): 167–83; Kirsch, *Proving Grounds*; Allen Isaacman and Chris Sneddon, "Toward a Social and Environmental History of the Building of Cahora Bassa Dam," *Journal of Southern African Studies* 26, no. 4 (2000): 597–632; Daniel MacFarlane, *Negotiating a River: Canada, the US, and the Creation of the St. Lawrence Seaway* (Vancouver: UBC Press, 2014). For a useful reminder that not all megaprojects were built, and that the resulting "unbuilt environments" have also been consequential, see Jonathan Peyton, "Corporate Ecology: BC Hydro's Stikine-Iskut Project and the Unbuilt Environment," *Journal of Historical Geography* 37 (2011): 358–69.

23 Tina Loo with Meg Stanley, "An Environmental History of Progress: Damming the Peace and Columbia Rivers," *Canadian Historical Review* 92, no. 3 (2011): 402.

24 See Patrick Joyce, "What Is the Social in Social History?", *Past and Present* 206 (2010): 213–48.

25 Loo, with Stanley, "An Environmental History of Progress," 406–08 (including Shapin). While the distinction between planners and engineers is a useful one, it does not seem necessary, historically speaking, to make it too sharply.

26 Joyce, "What is the Social in Social History?," 243.

27 Forest and Forest, "Engineering the North American Waterscape," 169.

28 Forest and Forest, "Engineering the North American Waterscape," 169; Farish and Lackenbauer, "High Modernism in the North."

29 C. C. Duncan, "Communications and Defense," *Bell Telephone Magazine*, Spring 1958, 15.

30 "Continental Defense," *WE Magazine*, July/August 1955, 27.

31 Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: University of Chicago Press, 2008), 80 (original emphasis).

32 Adams and Butler, *Manufacturing the Future*, 150.

33 A more thorough answer would begin in an earlier age of American militarization. Western Electric's history is twinned to that of the telegraph—the technology, along with the railroad, that was crucial to rapacious national expansion and what the geographer Cole Harris calls the "struggle with distance" in nineteenth century North America. According to David Noble, by the early twentieth century, "the large corporations of the electrical industry sought to dominate not only markets for their products but the manufacture of those products as well," through strategies of "industrial warfare." This language is appropriate: during the First World War, Western Electric employees and other representatives of the National Association of Corporate Schools supervised and advised the Army on training and rating of soldiers "according to their industrial abilities." After the war, the same group devised plans "for the reinfiltration of the soldiers into industry." Harris, "The Struggle with Distance," in his *The Resettlement of British Columbia: Essays on Colonialism and Geographical Change* (Vancouver: UBC Press, 1996), 161–93; Noble, *America by Design: Science, Technology, and the Rise of Corporate Capitalism* (Oxford University Press, 1977), 95, 208.

34 "Western Electric: A Brief History," 10.

35 John L. Rudolph, *Scientists in the Classroom: The Cold War Reconstruction of American Science Education* (New York: Palgrave, 2002), 85–86.

36 Quoted in Kent C. Redmond and Thomas M. Smith, *From Whirlwind to MITRE: The R&D Story of the SAGE Air Defense Computer* (Cambridge, MA: MIT Press, 2000), 298.

37 Gabrielle Hecht, "Introduction," in *Entangled Geographies: Empire and Technopolitics in the Global Cold War*, ed. Gabrielle Hecht (Cambridge, MA: MIT Press, 2011), 3.

38 Timothy Mitchell, *Rule of Experts: Egypt, Techno-politics, Modernity* (Berkeley: University of California Press, 2002), 42–43.

39 Farish and Lackenbauer, "High Modernism in the North"; William J. Rankin, "Infrastructure and the International Governance of Economic Development," in *Internationalization of Infrastructures: Proceedings of the 12th Annual International Conference on the Economics of Infrastructure*, ed. Jean-François Auger, et al. (Delft, Netherlands: Delft University of Technology, 2009), 61–75.

40 Mitchell, *Rule of Experts*, 43; see also Farish and Lackenbauer, "High Modernism in the North."

41 Hecht, "Introduction," 3.

42 Rudolph, *Scientists in the Classroom*, 86.

43 Scott Kirsch, "Laboratory/Observatory," in *SAGE Handbook of Geographical Knowledge*, ed. John A. Agnew and David N. Livingstone (Thousand Oaks, CA: SAGE, 2011): 80.

44 For one example, see Jim Lotz, "The North as a Laboratory," in *People of Light and Dark*, ed. Maja Van Steensel (Ottawa: Department of Indian Affairs and Northern Development, 1966), 68–71.

45 The quotes are from "Arctic Sentinels: Building Rushed on Radar

Defense," *Universal International News*, n.d., http://www.youtube.com/watch?v=cg4phLghz2U& (accessed 17 August 2011); and Western Electric, *Arctic Mission: A Report on Dew Line Activities* (1955), http://www.youtube.com/watch?v=nMZl6Xlm6ak (accessed 17 August 2011).

46 *Building the DEW Line* (New York: Audio Productions Inc., n.d.). A copy is in the Yukon Archives, Whitehorse (V-357).

47 Michel Foucault, "Space, Knowledge and Power," in *Power: Essential Works of Foucault, 1954–1984, Volume 3*, ed. James D. Faubion (New York: New Press, 2000): 364; see also Martin Heidegger, "The Question Concerning Technology," in Heidegger, *Basic Writings*, ed. David Farrell (New York: Harper and Row, 1977), 287–317.

48 AT&T Archives, Warren, NJ (hereafter cited as AT&T), Corporate Collection, Box 139-11-03, "DEW Line: Engineering in the Arctic," 1 (our emphasis).

49 On the multitudinous geographies of the American military-industrial complex, see the special issue of *Antipode* 43, no. 3 (2011).

50 Edward A. Ackerman, "Geographic Training, Wartime Research, and Professional Objectives," *Annals of the Association of American Geographers* 35, no. 4 (1945), 121–43.

51 On "vertically structured research organizations," particularly in astronomy, and the industrialization of science before Second World War, see Kirsch, "Laboratory/Observatory," 80.

52 See Stuart W. Leslie, *The Cold War and American Science: The Military-Industrial-Academic Complex at MIT and Stanford* (New York: Columbia University Press, 1993).

53 Bruce E. Seely, "The Other Re-engineering of Engineering Education, 1900–1965," *Journal of Engineering Education* 88, no. 3 (1999): 289.

54 David Kaiser, "Cold War Requisitions, Scientific Manpower, and the Production of American Physicists after World War II," *Historical Studies in the Physical and Biological Sciences* 33, no. 1 (2002), 131–59.

55 David Kaiser, "The Postwar Suburbanization of American Physics," *American Quarterly* 56, no. 4 (2044): 858. This was additionally a period when the demand for "applied science" was drawing engineering and physics much closer together in the United States. According to Seely, the University of Illinois's physics department was in the College of Engineering, and the university offered a degree in engineering physics during the 1940s. Seely, "The Other Re-engineering of Engineering Education," 290.

56 Shapin, *The Scientific Life*; see also Rudolph, *Scientists in the Classroom*, 85.

57 W. E. Burke, "The DEW Line: Sentinel of the Northland," *Bell Telephone Magazine*, Summer 1956: 73.

58 Kirsch, "Laboratory/Observatory," 77.

59 "Our People in the Far North," *The Reporter*, October 1955, 4. "Cooperation of the local farmers was not of the best, since security regulations precluded advising them of the true nature of the project and its military importance." J. D. Brannian, "Siting the DEW Line

Radar Stations," *Engineering and Contract Record* 70, no. 7 (1957): 55.

60 See the "Findings of Fact" document for the "USAF DEW Line Training Station," 5 June 2007, at www.radomes.org/museum/documents/Seward%20-%20E05IL334300_01.10_0001_a.pdf (accessed 5 April 2011).

61 AT&T, Radar Collection, box 172 06 02, folder 2, "Projects 572 and 540: Dew Line Engineering Report," 1 October 1957, 58. See also AT&T, Corporate Collection, box 139 11 03, "Dew Line: Engineering in the Arctic," 1. The Parks Canada historian, David Neufeld, who has carefully documented the history of the DEW Line in the Yukon, notes that from Barter Island, "the components for one station," originally pieced together and then disassembled outside of Streator, "were loaded on cat trains and hauled to the Canadian site through the spring of 1953." The experimental stations "were in operation by early 1954." Neufeld, *The Distant Early Warning (DEW) Line: A Preliminary Assessment of its Role and Effects upon Northern Canada* (revised for the Arctic Institute of North America, 2002), www.stankievech.net/projects/DEW/BAR-1/bin/Neufeld_DEW-Linehistory.pdf (accessed 17 September 2011).

62 Thomas Ray, *A History of the DEW Line*, Air Defense Command Historical Study 31 (Maxwell Air Force Base, AL: Air Force Historical Research Agency, 1965), 13.

63 James D. Brannian, et al., "W. E. Engineering for the DEW Line—I: Siting and Construction," *Western Electric Engineer* 1, no. 3 (1957): 3. These comments are from the editorial note accompanying this article.

64 "The DEW Line," *195 Bulletin*, November 1953, 7–8.

65 William Barrie, "Project 572 and WE8GY," 19 February 2008, http://qcwa70.org/PROJECT%20572%20&%20VE8GY.ppt.ppt (accessed 30 March 2011).

66 Brian (Simon) Jeffrey, "Adventures from the Coldest Part of the Cold War: A DEW Liner's Memoirs, 1960–63," http://www.dewlineadventures.com/wp-content/uploads/2013/02/Cold-War-Adventures-Rev2.5.pdf (accessed 13 June 2016), 11. For a fictional treatment of the Federal Electric years at Streator and on the DEW Line, see Charles Flynn, *Green Grass Fever* (London: Minerva Press, 2001). Contracted to train at Streator by the end of April 1956, Federal Electric personnel began arriving on the Line in October of that year, assisting "Western Electric installation crews in finalizing and check out of the communications and electronics equipment." Lynden T. (Bucky) Harris, "The DEWLINE Chronicles: A History," http://lswilson.dewlineadventures.com/dewhist-a.htm (accessed 13 June 2016); Ray, *A History of the DEW Line*, 33.

67 "Dew Line 'Radome' Constructed at Whippany Laboratory," *Bell Laboratories Record* 34, no. 8 (August 1956): 308.

68 See Nick Cullather, "Miracles of Modernization: The Green Revolution and the Apotheosis of Technology," *Diplomatic History* 28, no. 2 (2004): 227–54.

69 While Western Electric staff used "Project 572," the US Air Force referred to the Project as

COUNTERCHANGE, and later CORRODE.

70 "Dew Line: Engineering in the Arctic," 2.

71 Brannian, "Siting the DEW Line Radar Stations," 54–55.

72 *The DEW Line Story*, 6.

73 Brannian, "Siting the DEW Line Radar Stations," 173–75.

74 R. I. Thomas, "Photographic Operations of the Royal Canadian Air Force," *Arctic* 3, no. 3 (1950), 150–65. See also Moira Dunbar and Keith R. Greenaway, *Arctic Canada from the Air* (Ottawa: Defence Research Board, 1956).

75 See Stephen Bocking, "A Disciplined Geography: Aviation, Science, and the Cold War in Northern Canada, 1945–1960," *Technology and Culture* 50, no. 2 (2009), 26590.

76 Brannian, "Siting the DEW Line Radar Stations," 175, 197.

77 Ray, *A History of the DEW Line*, 16.

78 Ray, *A History of the DEW Line*, 14–15.

79 Alex Soojung-Kim Pang, "Dome Days: Buckminster Fuller in the Cold War," in *Cultural Babbage: Technology, Time and Invention*, ed. Francis Spufford and Jenny Uglow (London: Faber and Faber, 1996): 168.

80 The oft-used phrase "centre of calculation" is Bruno Latour's; see his *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987).

81 Latour, *Science in Action*, 175–76; Directorate of History and Heritage, Ottawa, file 79/87, *Project Corrode: Report on Summer Survey of Arctic Routes* (New York: Radio Division, Western Electric Company, 16 October 1953), 3. See also Neufeld, "The Distant Early Warning (DEW) Line."

82 *Documents on Canadian External Relations*, vol. 20-462 (4 June 1954), http://epe.lac-bac.gc.ca/100/206/301/faitc-aecic/history/2013-05-03/www.international.gc.ca/department/history-histoire/dcer/details-en.asp@intRefid=635 (accessed 13 June 2016).

83 *Documents on Canadian External Relations*, vol. 20-482 (12 November 1954), http://epe.lac-bac.gc.ca/100/206/301/faitc-aecic/history/2013-05-03/www.international.gc.ca/department/history-histoire/dcer/details-en.asp@intRefid=656 (accessed 13 June 2016). This document is an extract from the minutes of Canada's Cabinet Defence Committee, and includes a report from the recent Permanent Joint Board on Defence meeting.

84 Ray, *A History of the DEW Line*, 20–21. "Cost, plus fixed fee" is from "Contractor Chosen for Radar in Arctic." Resolution Island had been proposed as the terminus by Western Electric.

85 For an example, see Air Force Historical Research Agency, Maxwell Air Force Base, AL, file K243.0482-1, Western Electric Company, *Siting Report, Distant Early Warning Line Station Bar-B* (September 1955).

86 Ray, *A History of the DEW Line*, 21.

87 *Building the DEW Line*.

88 Leslie Roberts, "The Great Assault on the Arctic," *Harper's*, August 1955, 37.

89 W. E. Burke, "The Arctic Distant Warning System," paper presented at the 26th Annual Meeting of

the Institute of the Aeronautical Sciences, 27–30 January 1958, 3. A copy of this document is in the library of Air University, Maxwell Air Force Base, AL.

90 R. B. Wybou, "The Dew Line," *North* 7.4-5 (1960), 11.

91 Ray, *A History of the DEW Line*, 34.

92 "Western Electric: A Brief History," 12.

93 Marshall, "North America's Distant Early Warning Line," 623, 628.

94 While helpfully detailed, many of the publications authored by Western Electric employees are also strikingly similar and anodyne, tales of inexorable triumph over an environmental foe. See, for instance, V. B. Bagnall, "Operation DEW Line," *Journal of the Franklin Institute* 259, no. 6 (1955): 481–90; Bagnall, "Building the Distant Early Warning Line," *Military Engineer* 47, no. 320 (1955): 429–32; Brannian et al., "W.E. Engineering for the DEW Line"; and the three part-series in the *Engineering and Contract Record* (June, July, and August 1957 issues).

95 W. E. Burke to G. O. Ekstedt, 1 May 1958, letter attached to a copy of *The DEW Line Story* (New York: Western Electric Company, 1958), at http://www.beatriceco.com/bti/porticus/bell/pdf/dewline.pdf (accessed 21 January 2016). Burke's comments were contradicted in the attached book, but in an equally intriguing manner: "The area along the DEW Line may be desolate, but it is steeped in the history of Arctic exploration" (8).

96 *The DEW Line Story*, 6 (original emphasis).

97 *The DEW Line Story*, 24–25.

98 See Ray, *A History of the DEW Line*, 31–32. As this formerly secret document notes, there were also twenty-five fatalities from aircraft accidents during DEW Line construction in 1955 and 1956 (32).

99 *The DEW Line Story*, 19, 6.

100 Burke, "The DEW Line: Sentinel of the Northland," 69.

101 Burke, "The DEW Line: Sentinel of the Northland," 83.

102 Joyce, "What is the Social in Social History?", 245.

103 Contenta, "Dew Line."

104 *Project Corrode: Report on Summer Survey*, 8–9; *The DEW Line Story*, 12. This treatment of Indigenous northerners is certainly evident in the Western Electric-affiliated publications cited in note 94.

105 For example, Harold A. Edgerton, *Personnel Factors in Polar Operations* (Washington, DC: Office of Naval Research, 1953).

106 "Next Door to S. Claus," *WE Magazine*, November/December 1954, 47.

107 Marshall, "North America's Distant Early Warning Line," 628.

108 Neufeld, "The Distant Early Warning (DEW) Line." See also Burke, "The Arctic Distant Warning System," 19–20; and the 1955 report of Graham W. Rowley, representing the Canadian government on the US Navy's sea supply of the DEW Line's western sector, quoted in Yukon Archives, box GOV2858, file 4, David Neufeld, "History and Operation of Station BAR-1" (draft manuscript). Writers such as C. J. Marshall ("North America's Distant Early Warning Line," 627) hinted at a triangular relationship between DEW Line employment, increased Indigenous populations,

and declining "game resources." This is a claim worth pursuing (and challenging) further, given the documented concerns around increased hunting that accompanied the arrival of DEW Line workers, and the relationship between modernization, relocation, and conservation during the 1950s. See Peter Kulchyski and Frank James Tester, *Kiumajut (Talking Back): Game Management and Inuit Rights, 1900–70* (Vancouver: UBC Press, 2007), 105–9; John Sandlos, *Hunters at the Margin: Native People and Wildlife Conservation in the Northwest Territories* (Vancouver: UBC Press, 2007), 239.

109 The six MAIN stations were "where the most equipment and largest contingent of personnel were positioned for round-the-clock manning." They were "focal points for the operation, administration, maintenance and communication of the entire DEW Line," receiving data from smaller sites. Ray, *A History of the DEW Line*, 25.

110 J. D. Ferguson, *A Study of the Effects of the Distant Early Warning Line Upon the Eskimo of the Western Arctic of Canada* (Ottawa: Northern Research Coordination Centre, Department of Northern Affairs and National Resources, 1957), 26–27, 43; on social science and modernization, see Farish and Lackenbauer, "High Modernism in the North."

111 For more details and alternate perspectives on Inuit work at DEW Line sites, see Maxime Steve Begin, *Des Radars et Des Hommes: Memoires Inuit de la Station Fox Main de la DEW Line (Hall Beach, Nunavut)* (master's thesis, Université Laval, 2004). Sizing up the predicament in his bluntly titled 1964 survey *Eskimo Administration*, anthropologist Diamond Jenness recommended that the military should play a more interventionist social role. Diamond Jenness, *Eskimo Administration II: Canada*, Technical Paper 14 (Montreal: Arctic Institute of North America, 1964), 175, 183. Given the documented environmental and social legacies of the DEW Line, this suggestion seems troubling in retrospect. On military perceptions of social intervention, see P. Whitney Lackenbauer and Ryan Shackleton, "Inuit-Air Force Relations in the Qikiqtani Region during the Early Cold War," in *De-Icing Required: The Canadian Air Force's Experience in the Arctic*, ed. P. W. Lackenbauer and W. A. March (Trenton, ON: Canadian Forces Air Warfare Centre, 2012), 73–94.

112 Quoted in Annabel Jane Wharton, *Building the Cold War: Hilton International Hotels and Modern Architecture* (Chicago: University of Chicago Press, 2001), 8.

113 Burke, "The Arctic Distant Warning System, 19.

114 "First DEW Line Sites Turned over to Air Force," *Bell Laboratories Record* 35, no. 5 (May 1957): 194.

115 W. E. Burke to G. O. Ekstedt, 1 May 1958.

116 See Emilie Cameron, "New Geographies of Story and Storytelling," *Progress in Human Geography* 36, no. 5 (2012): 573–92; Mona Domosh, "American Capitalist Experiments in Revolutionary-era Russia," *Journal of Historical Geography* 39 (2013): 43–53.