6 THE NORTH ATLANTIC: TECHNOLOGY, THE ENVIRONMENT, AND LIBERALIZATION

In 1988, BT ran an advertisement to promote its international communication services. The same year, BT and AT&T, in collaboration with France Télécom, laid TAT-8, the first digital, fiber-optic, transatlantic communications cable. The advertisement opened with a shot of an empty business office, a desk and chair on the right and a computer terminal on the left. A businessman picked up a Filofax and began to dial his telephone. The camera then pulled out to reveal that the shot came from outside the businessman's office window. Evoking the short film *Powers of Ten* by Charles and Ray Eames, the camera pulled out farther until all London, including BT Tower, were in view, and continued pulling out: the UK, Europe, and, finally, Earth, floating in space. A communications satellite flew in front of the camera, momentarily obscuring the view of Earth, until the camera, quickly, began to zoom back in, this time to an office in Manhattan, New York. Another businessman picked up his phone and answered the call. The closing title card displayed "British Telecom International" as a voiceover said, "It's you we answer to," referencing BT's privatization in 1984, advertised as "a public company goes public."[1]

One year later, in 1989, AT&T, the US telephone operator, also ran an ad promoting their international communication services. In contrast to BT's, this ad mentioned TAT-8, with an early sequence in the commercial showing the cable-laying. Using similar imagery to BT, however, the AT&T ad opened and closed with a shot of the Earth from space. After the cable-laying sequence, the ad shifted to AT&T's new information services, through which customers could access the "worldwide intelligent network." This sequence

was interspersed with images of computers and space-age motifs, from satellites and earth stations to a NASA-style communications and telemetry control center, culminating with a phone call to astronauts in the space shuttle. The ad's closing title card contained AT&T's then-slogan, "The right choice," nodding to AT&T's divestiture in 1982, which broke the company into regional telephone providers and opened the long-distance US telephone network to competition.[2] These ads show that, in the wake of their monopolies ending, both BT and AT&T advertised their transatlantic communications services by focusing on satellites, rather than the cables that carried these services. This chapter investigates how the Post Office, BT, and AT&T managed this relationship between satellites and cables as transatlantic communications technologies. In doing so, the chapter shows how the Post Office and BT's turn from nationalized industry to private corporation intersected with the digitalization and liberalization of international communications markets.

The history of telecommunications is as much a history of international telecom infrastructures, regulations, and organizations as it is national. From the mid-nineteenth century, many telegraphic systems-builders prioritized international submarine telegraphy, particularly as a tool of empire.[3] The 1866 transatlantic telegraph led to Anglo-American hegemony over global telegraphy that has shaped contemporary discourse about global communications to the present day.[4] With the invention of wireless telegraphy, attention in the early twentieth century turned to the possibility of a global wireless network that, with some success, bypassed Anglo-American cable hegemony.[5] During the Cold War, communication satellites became the next focus of international communications. Led by the US, satellites became an extension of Cold War diplomacy that made international telephony and television broadcasting commonplace.[6] International communications has thus been a key site for making and remaking visions about the relationships among nations, corporations, empire, and the global economy.[7] But, in large part, this history has been dominated by the international agreements and organizations that govern and regulate these networks. The International Telecommunications Union, the key international governing body for telecommunications, originated as a "capitalist compromise" between nation-states and business.[8] It has since become a key site of "technocratic internationalism," where engineers weigh in on national and international issues and reach decisions about international telecommunications.[9] In the

postwar era, as satellites took off, a new organization, INTELSAT, appeared to administer and govern international satellite communications.[10]

But focusing only on these international organizations would miss the central role that international communications markets played for national telecom operators such as the Post Office, BT, and AT&T. For much of the twentieth century, international telecommunications markets were quite well-regulated, particularly the transatlantic markets that this chapter focusses on. In Europe, the domestic PTT monopolies usually controlled their end of international communications links, which were either long-distance radio or submarine cables. In the US, AT&T was forced to divest its international subsidiary, ITT, in 1925 and could operate only the US end of international telephony links, while various carriers, such as RCA and Western Union International, competed to provide international telegraphy services. In general, telecom operators from one country, such as the Post Office or AT&T, could not operate telecom networks in another country. In the period that this chapter covers, various changes challenged the regulation of international communications markets.[11] Advances in satellite and submarine cable technology expanded the supply of international communications circuits, causing the cost of international communications to drop. In turn, business users, the biggest purchasers of these international links—which traditionally cross-subsidized domestic residential users by paying higher prices for international communications—pushed for deregulation and liberalization so they could pay lower prices and expand their international networks. Meanwhile, the deregulation of national telecom monopolies, especially of AT&T and BT, freed those companies to compete in offering new international network services. This all means that the North Atlantic telecom markets played a central role in the privatization and liberalization of both international and domestic telecommunications operators. In short, to understand the relationship between digitalization and the market turn in British telecommunications, understanding this transatlantic history is essential.

This chapter treats the North Atlantic as a "technological zone."[12] A technological zone is a space made through the ways that technologies connect and encircle firms and nation-states. For example, Windows compatibility creates a technological zone for software that spans nations yet remains bounded by one business, Microsoft. In keeping with this chapter's aim to understand how the denationalization of Britain's telecom infrastructure

projected itself beyond Britain, these zones problematize the idea that there is a clear "inside" and "outside" to the nation-state. Because they involve malleable technologies, these zones require "frequent maintenance work."[13] Part of this work is institutional, undertaken by international organizations and transnational business partnerships. But it is also environmental. This history builds on work that draws attention to the historical intersections of technology and the environment, particularly the environmental history of the ocean, outer space, and communications technologies.[14] This chapter pays attention to the environments of North Atlantic communications, alongside its technologies and its institutions, because all three are essential to understanding the political economy of transatlantic communications that AT&T, the Post Office, and BT built and rebuilt from the 1950s to the 1980s.

This chapter unfolds in three parts. The first, which includes "Conquering the Atlantic" and "Hostile Environments," looks at how the national monopolies of the Post Office and AT&T worked on two new transatlantic communications projects, the TAT-1 submarine telephone cable and the Telstar communications satellite. This part explores both the environmental and regulatory histories of these projects, showing how these histories set up particular ways of thinking about the roles that cables and satellites played in transatlantic communications. Next, "The Single World System" looks at the "battle of the systems" between the North Atlantic cable system and a new international satellite system, INTELSAT. INTELSAT institutionalized Cold War satellite techno-diplomacy as part of US foreign policy agenda, while the North Atlantic telecom monopolies developed new organizational and environmental strategies to protect cables from the threat posed by satellites. Finally, "Cables Orbit Satellites" looks at how BT and AT&T, as newly denationalized telecom corporations, promoted new satellite and cable technologies, including TAT-8, the first digital fiber-optic transatlantic communications cable, to support the liberalization of international communications.

CONQUERING THE ATLANTIC

On September 25, 1956, AT&T and the Post Office opened TAT-1, the first transatlantic telephone cable. TAT-1 incorporated various new and old techniques for surviving the Atlantic environment. Crossing the far north of the Atlantic from Oban in Scotland to Clarenville in Newfoundland, the cable

route was chosen for infrastructural and environmental purposes. Further south were telegraph cables, which might disrupt the new cable, and dangerous areas of the seabed, susceptible to turbidity currents, sediment-laden flows of water that could snap cables, as had happened following the 1929 Grand Banks earthquake and the 1954 Orleansville, Algeria, earthquake. On a technical level, new undersea repeaters, developed at Bell Labs, had made TAT-1 possible. These repeaters, which amplified and extended telephone signals, had to work reliably under the immense pressure at the bottom of the Atlantic. The repeaters used this high-pressure environment to their advantage. Their metal casings, unavoidably deformed during the cable-laying process, relied on the immense pressure at the ocean floor to pressure them back into their correct shape.[15] The Post Office had contributed to TAT-1 by designing its shallow-water repeaters, used in the link between Newfoundland and the North American mainland, and by using Her Majesty's Telegraph Ship, *Monarch*, the largest cable ship afloat at the time. TAT-1 used two cables, one for each direction of transmission, and *Monarch* was the only ship capable of transporting the entire cable length for one direction. TAT-1's final novelty, showing another intersection of technology and environment, was its innovative polyethene cladding, used to resist biological attack from marine bacteria, in contrast to previous cables' weaker polyvinyl chloride coatings.[16]

These harsh environmental conditions formed a major part of AT&T's publicity about transatlantic telephony in the late 1950s and early 1960s. Ads in boys' magazines talked about how the sea "could make a 'meal' of telephone cables" (figure 6.1) and explained Bell Labs' "experimental ocean," used to test cable specimens in saline conditions.[17] Advertisements also targeted business audiences, with ads in *American Banker*, the *Wall Street Journal*, and *Fortune* explaining how AT&T's "stormproof" Atlantic cable would allow them to expand US business interests in Europe.[18] A series of ads by AT&T called "Tele-Facts" deployed militaristic language to describe TAT-1 and, by extension, AT&T as "conquering the Atlantic." This militaristic tone pervaded many of AT&T's TAT-1 ads.[19] The same ads that ran in *American Banker* and *Fortune* explained how TAT-1 would be of "far-reaching value in national defense," while articles in *Bell Telephone Magazine* compared TAT-1 to Cold War projects like the Distant Early Warning Line and the Ballistic Missile Early Warning System.[20]

These Cold War geopolitical concerns were particularly evident in the trilateral negotiations for TAT-1 among the United States, Britain, and Canada.

FIGURE 6.1
The sea could make a "meal" of telephone cables! Credit: N W Ayer Advertising Agency Records, Archives Center, National Museum of American History, Smithsonian Institution.

TAT-1's route, devised by AT&T and Post Office officials, also fulfilled a British goal of strengthening UK–Canadian communications and extending the "all-red" Commonwealth communications route to reach New Zealand via Canada and the Pacific.[21] US officials found this problematic and had two security concerns. First, regarding the cable landing in Canada rather than in the United States, and second, over the plans for the Post Office rather than AT&T to design and contract out construction of the shallow-water Newfoundland–Nova Scotia section.[22] The US proposed instead to staff the Canadian cable stations with US AT&T staff. In response, Canadian officials expressed concerns on security and commercial grounds, fearing that it would pave the way for the commercial expansion of US telecommunications into Canada.[23] The Canadians' attitude raised concerns for the UK, where Foreign Office and Post Office officials worried that Canadian intransigence would cause the US to lay a cable directly to France instead.[24] The resulting compromise was that a Canadian AT&T subsidiary, the Eastern Telephone and Telegraph Company, would operate Canadian sections, the Canadian Overseas Telecommunication Corporation would take a 10 percent minority stake in TAT-1, and the Post Office would design the Newfoundland–Nova Scotia section. In return, the next transatlantic cable, TAT-2, would run from the United States to France to avoid concentrating traffic through the UK.[25]

An AT&T publicity film for TAT-2, which was laid in 1959, further shows the entanglement of these cables' environments with US Cold War geopolitical concerns about Europe. The film opens with scenes of waves crashing on rocks and emphasizes the cable's victories over the "many-mooded sea," describing battles against the wind, cold, and icebergs. It concludes that the cable "should do much to bring many nations closer together, both politically and economically, and contribute significantly to the defense needs of the free world" and was "man's newest memorable victory over distance and the sea."[26] This film captures how the undersea cables' environments were crucial to a discourse about extending US military and economic influence into Europe. The early transatlantic telephone cables were part of the US "consensual hegemony" over Europe, in which the US used scientific and technological projects in the early Cold War to aid European reconstruction and serve its Cold War defense interests.[27]

In contrast, the Post Office used TAT-1's environment to emphasize the British scientific and technological ingenuity that had made TAT-1 a "world first." At the cable's opening ceremony, Charles Hill, the postmaster-general,

highlighted the engineering prowess and patient research behind the cable, while the Post Office's official souvenir booklet emphasized British oceanographic knowledge and manufacturing skill.[28] Gordon Radley, then the Post Office's director general, spoke on the BBC radio Home Service program *Science Survey* in September 1956 about TAT-1 as a "significant scientific achievement."[29] Radley described the cable resting in the "perpetual darkness and ooze of the sea bed," evoking Rudyard Kipling's poem "The Deep-Sea Cables": "There is no sound, no echo of sound, in the deserts of the deep, / Or the great grey level plains of ooze where the shell-burred cables creep."[30] But where Kipling's poem portrayed cables as a globally unifying force, transcending their environment, Radley's talk and the Post Office's TAT-1 publicity instead resembled the nationalism of Highgate Wood. Even though AT&T's deep-sea repeaters had enabled TAT-1, the Post Office's repeated emphasis on Britain's contributions revealed a distinctly nationalist tinge.

This British nationalism also extended to the Post Office's efforts to unsettle the regulation of transatlantic communications in the UK's favor.[31] Before TAT-1, transatlantic telephony and telegraphy were operated under different regulatory arrangements. AT&T and the Post Office operated radiotelephony links, while US "international record carriers," such as Western Union International and RCA, operated wireless and cable telegraphy. This was a regulatory arrangement set up in the US in the early twentieth century to prevent AT&T expanding its domestic monopoly to international communications. But TAT-1, as the first coaxial transatlantic cable, would have a bandwidth that meant that the Post Office could offer both transatlantic telephone and telegraph services. This threatened the balance of power in the US between AT&T, as the international telephony provider, and the record carriers, which provided international telegraphy. Soon after the Post Office and AT&T signed the first agreement to lay TAT-1 in 1952, ITT thus announced that its subsidiary, the Commercial Cable Company, would lay a new coaxial transatlantic cable, code-named Project Deep Freeze, for telegraph services alone. This cable upheld the existing US regulatory framework and would continue to exclude the Post Office from transatlantic telegraphy. After negotiations that went on into 1956, the Post Office continued to refuse ITT a license to land Deep Freeze in the UK, while the US continued to block telegraph services over TAT-1.

When TAT-1 launched, it thus carried telephony only between the US and the UK, but, because it went via Canada, the Post Office used TAT-1 for

international telegraphy services to Canada. TAT-1 was a huge success. It carried twice as many calls as radiotelephony had done in the previous year and brought in significant revenue for its US, Canadian, and British operators. Indeed, TAT-1 was so successful that the UK and Canada immediately began planning a new transatlantic coaxial cable, CANTAT-1, which would carry transatlantic telephony and telegraphy and would exclude AT&T. This finally forced changes in the US regulation of international communication. The US international record carriers could not abide the chance that their North American customers would start routing all telegraph traffic via Canada to go over CANTAT-1. The FCC thus agreed, in 1959, that the record carriers could lease circuits from AT&T over TAT-1 and the Canadian Overseas Telecommunication Corporation over CANTAT-1, finally ending the separation between international telegraphy and telephony. This meant that these international record carriers stopped laying new transatlantic cables, and indeed, through the 1960s, they also stopped operating their old transatlantic telegraph cables, instead leasing circuits on coaxial telephone cables, which, if they landed in the UK, were all partly owned by the Post Office. The Post Office thus achieved its goal of excluding the US record carriers from the UK, and it had expanded its monopoly over the British end of transatlantic communications from telephony to telegraphy.

HOSTILE ENVIRONMENTS

In the early 1960s, space-based communications took off. AT&T and the Post Office initially presented satellites as complementary parts of their international services, although new attitudes to space as an environment and zone of Cold War conflict also appeared. In the US, this occurred with the launch of AT&T's Telstar satellite, while in Britain, this happened with the Post Office's construction of Goonhilly Downs, Britain's first satellite earth station. Telstar, launched in July 1962, was the first satellite to relay telephony and television across the Atlantic, from AT&T's earth station in Andover, Maine, to British and French earth stations at Goonhilly Downs, Cornwall, and Pleumeur-Bodou, Brittany. Bell Labs' initial research into satellite telephony came in 1955, but its R&D program began in earnest in 1959 when AT&T agreed with NASA that AT&T would design and construct an active communications satellite for NASA to launch.[32] This satellite, Telstar, was roughly spherical, composed of seventy-two facets covered in sixty solar cells and three mirrors,

which aided satellite tracking from Earth. The satellite weighed 170 pounds and contained a single amplifier that could transmit a wide-band signal, such as a television broadcast, one way, or two narrow-band signals, such as a telephone call, two ways. Telstar's purpose was not only to prove the viability of satellite communications but also to gain an understanding of the space environment, particularly the Van Allen radiation belts surrounding Earth, discovered by James Van Allen at the University of Iowa in 1958 using data from the Explorer 1 and Explorer 3 satellites.[33]

AT&T situated these space activities alongside transatlantic telephone cables in its publicity. After its early experiments in space communications in the late 1950s, AT&T ran a widely published series of ads with the header "From Beyond the Sky to Beneath the Seas" in military and science magazines (figure 6.2), juxtaposing the sea and space environments to demonstrate the breadth of AT&T's accomplishments.[34] The ads' appearance in military magazines further demonstrates the militarization of Cold War transatlantic communications discourses. College recruitment ads also used TAT-1 and Telstar. One poster described how "Between Outer Space and the Deep Sea There's a Wide Range of Opportunity in the Bell Telephone Companies," while another explained how "progress in the Bell System," among other things, "swims" and "orbits."[35]

The Telstar experiment also interlinked the hazards of the space environment with the growing environmental awareness of the 1960s, which raised concerns about US militarization of the space environment after the Telstar experiment. Telstar had been launched not only as a communications satellite, and, as AT&T publicity explained, it was also a "space laboratory," "operating in the unknown environment of hostile radiation and micrometeorite dust," sending back data about the space environment to Bell Labs.[36] The day before Telstar launched, the US detonated Starfish Prime, the largest man-made nuclear explosion in outer space, part of a series of high-altitude nuclear weapons tests called Operation Fishbowl. This detonation energized the Van Allen belt, which damaged transistors on Telstar, causing it to fail. The failure of Telstar and seven other satellites, including Ariel I, Britain's first satellite, caused by Starfish Prime, highlighted the hazardous environment of space and fed environmental concerns about the damage US military programs were doing to outer space. Newspaper articles linked Telstar's failure to Operation Fishbowl's potential damage to the space environment, and James Van Allen criticized the military tests, which used data

FIGURE 6.2
Telstar and TAT-1: "From beyond the sky to beneath the seas." Credit: N W Ayer Advertising Agency Records, Archives Center, National Museum of American History, Smithsonian Institution.

from Telstar to study the explosions before its failure, for projecting a "sinister" air around the program.[37] Telstar's failure and its links to Operation Fishbowl were a "proto-environmentalist" moment, stirring Cold War environmental insecurities and showing that nuclear weapon detonations in space were not just about weapons testing, but also about environmental transformation.[38] Telstar's failure, which made visible the militarization and nuclear pollution of the space environment, was thus part of the broader rise of environmentalism as "a child of the Cold War."[39]

Other early approaches to space communications showed how attempts to manipulate the space environment came from efforts to bypass undersea cables. In 1961, MIT's Lincoln Laboratory began Project West Ford, attempting to create an artificial ionosphere by placing 480 million copper needles in orbit. These needles would act as a passive antenna to bounce communication signals from one place to another. Project West Ford aimed to reduce the US military's reliance on undersea cables after a Soviet fishing trawler was suspected of deliberately cutting transatlantic telephone and telegraph cables owned by AT&T and Western Union in 1959.[40] Protests against Project West Ford occurred in both the UK and the USSR, and the project eventually came under criticism within the US too. British radio-astronomers, such as Bernard Lovell, worried about how the needles might affect radio astronomy, while in the USSR, *Pravda* attacked the US with the heading "USA Dirties Space," calling the needles "space junk."[41] In the US, the *New York Times* argued that the US had no unilateral right to influence the space environment.[42] Operation Fishbowl and Project West Ford show that, while AT&T initially positioned Telstar as complementing TAT-1, early space communications escaped this rhetorical frame, instead representing the US militarization of the space environment.

Meanwhile, the Post Office used space communications to emphasize British engineering ingenuity and technological mastery over the natural environment. Satellite histories tend to focus on the cosmic and not the terrestrial, but satellite communication is more than satellites in space.[43] It is also a vast, material, terrestrial infrastructure composed of, by now, hundreds of earth stations around the world. Earth stations are essential nodes in communication satellite infrastructure, and the Telstar experiment required three earth stations in three different countries. The Post Office built its first earth station, Goonhilly Earth Station Office, in 1962 on Goonhilly Downs, an isolated, elevated plateau on the Cornish peninsula with broad sightlines.

The Post Office pursued a unique direction for Goonhilly's design. The first antenna, Antenna One, also known as Arthur, was the world's first satellite communication antenna with a parabolic design. The antenna was designed by Charles Husband, the engineer behind Jodrell Bank's Lovell Telescope, the world's largest steerable radio telescope, which had also used a parabolic design and was the world's first satellite "dish."[44] The Post Office proudly touted Antenna One's parabolic design as a uniquely British design concept that did not need environmental protection, in contrast to AT&T's Andover, Maine, earth station, which utilized a "horn" antenna that required protection from the environment by a distinctive "golf ball" protective radome.[45] The Post Office mobilized Goonhilly's dish as part of its publicity, featuring it in its "Progress" poster series (figure 6.3).[46] The Post Office later proudly touted how the British parabolic design became the template for subsequent earth stations worldwide, again emphasizing the Post Office's role in British technological exports. Goonhilly, however, was not a complete success. Initial communication with Telstar failed because a component was accidentally inverted, disrupting the Post Office's image of British technological sophistication. The prime minister, Harold Macmillan, demanded an explanation from the Post Office, which explained the simple error behind Goonhilly's failure while also replying that Goonhilly had cost a quarter as much as the French earth station and had showcased Britain's expertise in antenna construction.[47]

The expansion of space communications brought concerns about interference in the radio spectrum, which had consequences for Goonhilly. As international satellite communication developed alongside domestic microwave networks, the radio spectrum became increasingly congested. Radio astronomers at Jodrell Bank had already experienced such issues, which were a familiar problem for scientific establishments, where electrical interference often disturbs instruments.[48] Mitigating interference had thus been an early priority for the Telstar experiment. In order to standardize communications and replicate signal transmission, the French had, at considerable expense, duplicated and imported AT&T's Andover earth station for their earth station at Pleumeur-Bodou, Brittany.[49] For Goonhilly, growing interference meant that, by the 1970s, it could no longer serve as Britain's only earth station. The Cornish peninsula had been ideal for transatlantic satellites, but southeast facing aerials, pointed at satellites stationed above the Indian ocean, were prone to interference from French microwave networks across the English Channel (figure 6.4).[50]

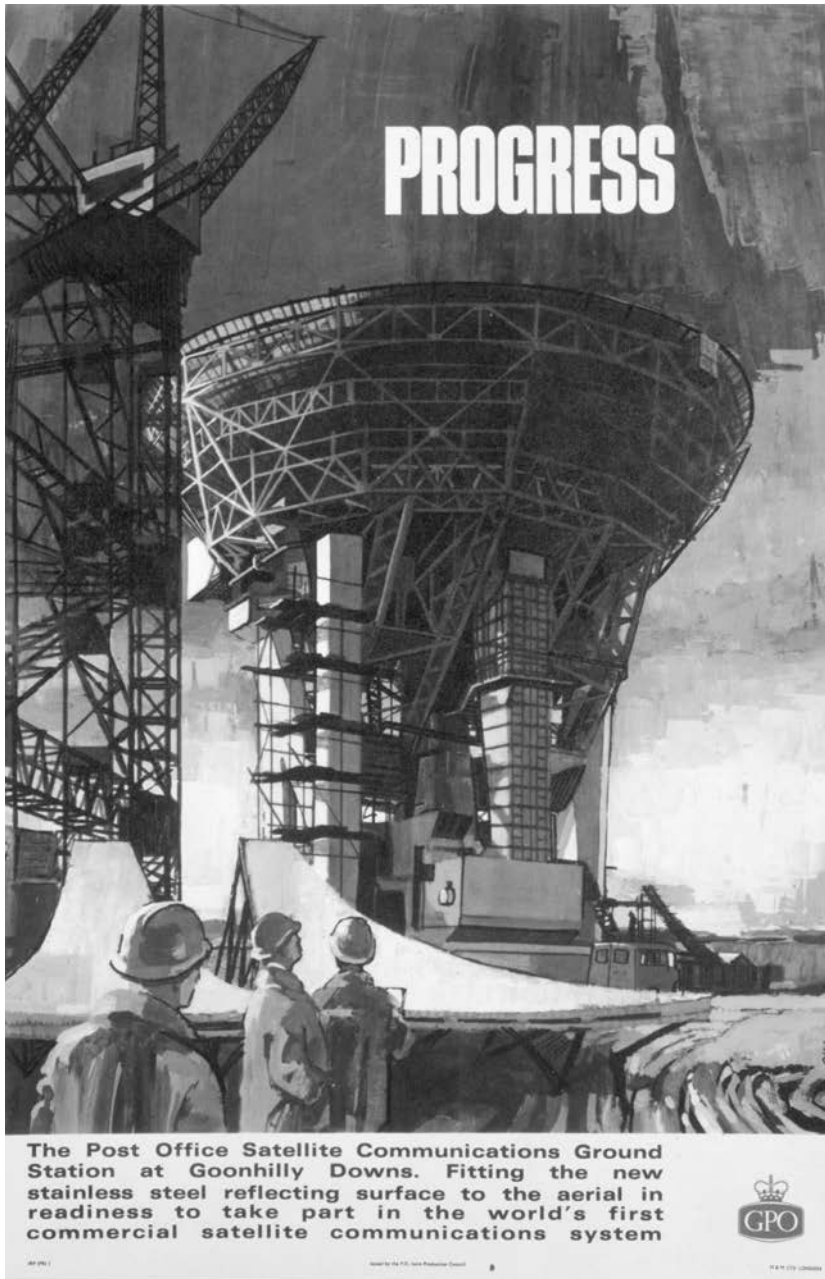

FIGURE 6.3
Goonhilly also appeared in the "Progress" poster series. Source: TCB 420/IRP (PR) 1, BT Archives. Courtesy of BT Group Archives.

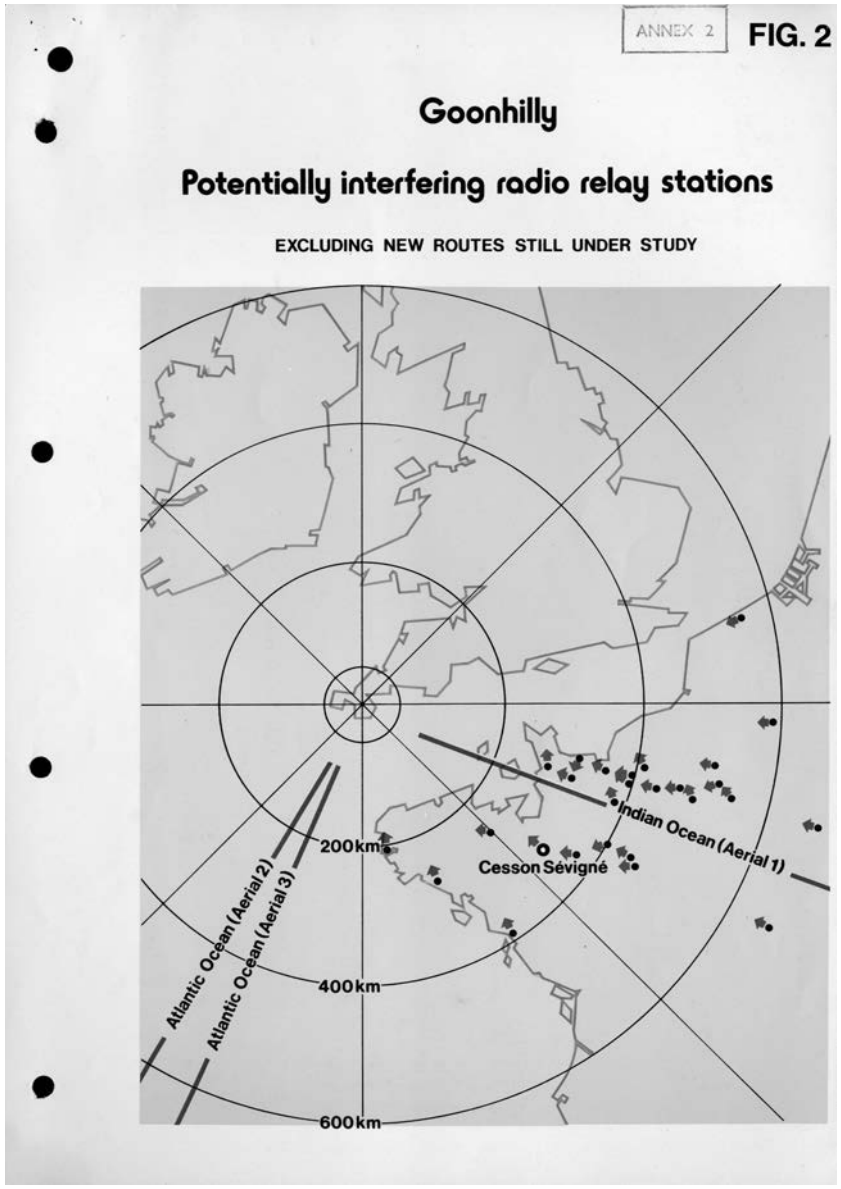

FIGURE 6.4
Interference between Goonhilly and French microwave relay stations. Source: TCC 55/6/145, BT Archives. Courtesy BT Group Archives.

Britain's second earth station, Madley, which opened in 1978, thus had a northern, inland position in Herefordshire with better sightlines. This location protected Madley from interference from the continent and Goonhilly, which remained in service until 2008. Goonhilly's fate and Madley's construction demonstrate that earth stations and, indeed, all wireless communication stations, are both susceptible to interference and producers of it, which is an essential detail for a full environmental history of the radio spectrum. The electromagnetic spectrum is an invisible environment that intersects with the spatiality of communications infrastructure and other scientific and technological institutions such as radio telescopes and metrological laboratories. By 1968, this was already such a concern that an article in AT&T's *Bell Telephone Magazine* described the spectrum, in which AT&T had invested a significant amount with its domestic microwave network, as a "natural resource" being "polluted."[51] Goonhilly's history shows that, while the Post Office presented it as a uniquely British earth station, it was by no means nationally bounded and instead remained always open to the transnational extension of the electromagnetic environment.

THE SINGLE WORLD SYSTEM

Telstar proved the viability of satellite communications, so attention turned to global satellite systems, which ultimately took form in the INTELSAT "single world system." The US spearheaded the creation of INTELSAT as a satellite system with global access and Cold War objectives. Soviet success with Sputnik and Yuri Gagarin had left the US lagging in the space race. The Kennedy administration thus saw an international satellite alliance as a way to gain prestige, catch up to the USSR, and align neutral developing nations in the third world with the US. Broadcasting television and propaganda worldwide through a global satellite system could be a powerful weapon for US foreign policy. Negotiations thus started with foreign governments to gather a consortium of nations to invest in and support an international satellite system. The 1962 Communications Satellite Act created COMSAT, a publicly traded corporation that represented the US in these negotiations, and the courtship of foreign governments began.[52]

INTELSAT had a profound influence on the Post Office, BT, and AT&T's development of transatlantic communications. The Post Office had to negotiate its commitment to submarine cables with the growing support for a

single international satellite system. The Post Office's early interest in satellites came from its desire to create a complementary Commonwealth satellite system that would interlink with cables.[53] There was also potential for a European satellite system, in which the Post Office was reluctant to invest. It would have to pay both purchase costs for the European launcher, developed by the European Launcher Development Organisation, and development costs, as the launcher was still in development. The Foreign Office foresaw political problems with both Commonwealth and European systems and, given the US head-start on satellite development, convinced the Post Office that the US-led international system represented the best option for British industrial, telecommunications, and Commonwealth interests.

The Post Office enrolled the Commonwealth in this strategy through the Commonwealth Conference on Satellite Communications in 1962. While the Post Office still emphasized at the conference its preference for a complementary cable and satellite system, it led talks that concluded that the Post Office, in conjunction with Canada, should undertake exploratory talks with the US about the new international satellite system.[54] European interests coalesced through the Conference of European Postal and Telecommunication Administrations, which agreed not to establish a regional satellite system in opposition to the US, although the European Conference on Satellite Telecommunications, CETS, was established for long-term planning. Through concerted negotiations by COMSAT and the US State Department, the groundwork for a single global satellite system had been laid by 1963.

A significant opportunity to voice further opinions came in 1963, at the Extraordinary Administrative Radio Conference, organized by the International Telecommunications Union. The US used this conference to secure frequency allocations for the single global system, strengthen ties with its European allies, and undertake "missionary" work, promoting technical assistance programs with potential third-world supporters.[55] Meanwhile, the Post Office used it to parade Goonhilly and argue in favor of an interconnected satellite-cable system.[56] In a technical paper, the Post Office again touted Goonhilly's unique, parabolic, unprotected antenna and described another unique feature, its use of computer prediction, rather than automatic tracking, for the steering aerial. This computer used orbital data to predict satellite movement so that the antenna would not need to be steered to acquire satellites after they appeared over the horizon. The Goonhilly computer proved helpful at the conference and was used, via Telex, to calculate degrees of

interference between different radio-communication services, which was another opportunity for the Post Office to deploy Goonhilly to emphasize its technological prowess.[57] The Post Office also submitted a resolution that a satellite system should interconnect with international communication cables. The resolution argued that the time-delay and Doppler frequency shifts associated with satellite transmission necessitated an interconnected system that provided various transmission routes, such as undersea cables, to mitigate these issues. This resolution and the continuing commitment by countries such as France to their cable networks meant that the US eventually conceded, putting sharing criteria in place for satellite systems to interconnect with terrestrial networks.

In 1964, INTELSAT finally formed through an interim agreement that would formalize in 1971. The US, through COMSAT, owned half, while major partners from Europe and around the world, including Canada, Japan, and Australia, owned the other half. As Britain's representative, the Post Office was the second-largest single shareholder behind the US, with an 8.4 percent ownership share.[58] Reflecting its goals and organization as a "single world system," INTELSAT supported a globalizing liberal democratic Cold War discourse through the 1960s and 1970s and emphasized satellites as superior and environmentally transcendent compared to submarine cables as part of this discourse. "One world" discourses of various valences proliferated through the 1960s. In 1962, the media theorist Marshall McLuhan, in *The Gutenberg Galaxy*, popularized the term "global village," while the digital utopian writer-entrepreneur Stewart Brand seized on the first photos of Earth from space as a call-to-arms for his countercultural publication, the *Whole Earth Catalog*.[59] Before a specific INTELSAT discourse stabilized, the first INTELSAT satellite, Early Bird, was caught up in a McLuhan-esque "communications explosion" discourse. For example, Early Bird appeared on the front cover of *TIME* magazine, drawn by Saul Steinberg. Steinberg drew Early Bird beaming a "communications explosion," an unsettling jumble of geometric shapes, into a man's head, designed to convey the view of space communications as "a maze of reflections of one thing to another" and "the somewhat frightening prospect of man's new capability to store a mass of information and, on signal, send it to anywhere in the world."[60]

By the end of the 1960s, the INTELSAT discourse had stabilized into a rhetoric of communication satellites as agents of global peace and unity, with registers of liberal democratic capitalism and the highly anticipated information

revolution. An ad by Hughes, Early Bird's manufacturer, explained that with the satellite, "the future looks bright. It includes increased world trade and better understanding between nations."[61] A COMSAT fact sheet explained how satellites would "increasingly handle even more futuristic chores" such as data exchange and facsimile. At the Early Bird inaugural address, President Lyndon B. Johnson proclaimed that the Early Bird service "brings closer together lands and people who share not only a common heritage but a common destiny."[62] Two years later, in 1967, at the launch of the INTELSAT II satellite over the Pacific, Johnson invoked similar rhetoric. He described that satellites would make space "a zone of peace, devoted to the purposes of all mankind," while Rosel Hyde, chairman of the Federal Communications Commission, described how the satellite would improve "the flow of knowledge and commerce across new high-capacity highways of communications."[63]

This discourse peaked at the signing of the official INTELSAT accords in Washington in 1971 with the contributions of science-fiction author Arthur C. Clarke. Clarke had originally proposed a geosynchronous satellite system in a 1945 article in *Wireless World*, and as such, INTELSAT regularly invoked his fame and predilection for grand predictions. At the accords' signing, Clarke explained his belief that "communication satellites can unite mankind" and informed the signatories that they had "just signed a first draft of the Articles of Federation of the United States of Earth."[64] In a 1971 article for *Popular Science* about the new INTELSAT IV series of satellites, Wernher von Braun, the infamous German American aerospace engineer, wrote that INTELSAT would establish what "Arthur Clarke, prophetic writer on space, has called 'mankind's first nervous system,' which will 'link together the whole human race.'"[65] The INTELSAT III series press handbook used the same quote. Clarke also wrote a guest editorial in *Bell Telephone Magazine*, in which he linked communication satellites with computers, suggesting that, while the enormous channel capacity of satellites may not be needed for a billion simultaneous human conversations, they would certainly be needed for computers, "which are becoming more talkative than their human creators."[66] What this discourse missed, however, was the extent to which US culture shaped INTELSAT's "one world." INTELSAT satellites monopolized international television transmissions, which were dominated by the broadcast of US television abroad. These satellites were thus less about "one world" and more about the US following its postwar "consensual hegemony" over European reconstruction with a cultural hegemony over international media.[67]

INTELSAT reorganized international communications to favor satellites over cables, emphasizing satellites' large bandwidth, as well as undersea cables' fragility and satellites' apparent environmental transcendence. Wernher von Braun's *Popular Science* article touted the superior capacity of INTELSAT IV compared to the "puny" capacity of the "most sophisticated transatlantic cable." A COMSAT brochure titled "New Communications Era" explained that the "archaic" cable system was no longer necessary and that Early Bird nearly doubled the capacity of TAT cables at less than one-fifth the cost.[68] In June 1965, COMSAT seized on the failure of the Canada-to-England transatlantic cable, CANTAT, to petition the FCC for temporary replacement service via Early Bird, and quickly publicized Early Bird's rescue of transatlantic communications.[69] The same occurred three years later when COMSAT publicized how INTELSAT satellites had carried their heaviest ever load of Atlantic traffic after two transatlantic cables had been damaged.[70] An INTELSAT educational booklet explained how satellites were superior to cables both as agents of global peace and understanding and as a medium for many new types of communication.[71] INTELSAT also perpetuated the notion that satellites could escape the "inherent limitations" of the environment, whereas terrestrial communications, in the environmental degradation of radio communications or the fragile materiality of cables, could not.[72] These ideas were also articulated outside INTELSAT and COMSAT. *Aviation Week* reported INTELSAT IV's capacity of three thousand to nine thousand circuits compared to the 750 of the most recent transatlantic cable, while *TV Guide* drew together the supposed differences in capacity and environment in an article about the growing demand for international communications.[73] *TV Guide* simultaneously emphasized the superior capacity of INTELSAT and the environment of submarine cables with the rhetorical question, "Meet that demand with undersea cables? They'd drown in an ocean of words. But satellites can handle it." Cables had been submerged, both literally and figuratively, while satellites appeared a capable, transcendent technology.

CABLES ORBIT SATELLITES

The INTELSAT system and communication satellites significantly influenced the Post Office, BT, and AT&T's development of transatlantic communications. This influence unfolded in three ways. First, the INTELSAT system inspired a North Atlantic Systems Conference, led by AT&T and the

Post Office, that resisted the satellite system. Second, BT and AT&T began to develop systems that would bypass INTELSAT and pave the way for the liberalization of international communications. Third, BT and AT&T subverted INTELSAT's discourse about satellite communications to advertise their own corporate, privatized model of international communications, focusing on satellites, computers, and free enterprise.

The Post Office continuously researched and monitored the proficiency of both satellites and submarine cables. In 1968, researchers produced five reports comparing satellites and cables.[74] One paper addressed noise performance, concluding that cable circuits had marginally better performance, while satellites were more susceptible to rain and atmospheric conditions causing bursts of noise. One compared propagation conditions while another addressed the fallibility of earth stations, noting that snowfall on a German earth station's radome had canceled a satellite TV broadcast from Germany, and that radome repairs had also put Andover and Pleumeur-Bodou out of action for extended periods. The final paper compared satellites and cables' relative secrecy, concluding that submarine cables were more secure, but also noted that in the future, satellites with highly directional aerials could target just a few square miles around the earth stations, increasing security. Donald Wray, the deputy director of engineering and the Post Office engineer who had planned Goonhilly, dryly noted, however, that if "the Red Chinese started building an earth station in Cornwall their activity would not pass unnoticed." Wray's overall analysis emphatically concluded that cables were superior to satellites. Cables had greater secrecy, simplicity, lifespan, and transmission time, while satellite earth stations were more complex and had higher personnel requirements than cable stations. The Post Office's Joint Submarine Systems Development Unit, run with Cable & Wireless, also noted that satellites were less susceptible to malicious and electrical interference but pointed out that, in the event they were damaged, cables could be repaired whereas satellites could not.[75]

By 1976, eight cables crossed the Atlantic, six in the TAT series and two in the CANTAT series, and various techniques were developed to protect and repair these cables. In 1970, the Post Office used a "sea-plough," developed by AT&T, to bury 80 miles of TAT-3 off the Cornish coast to protect the cable from fishing trawler damage.[76] In 1970, I. R. Finlayson, the Post Office's submarine superintendent, commissioned a marine consultant, Lieutenant Commander Lovell-Smith, to report on the viability for a diving unit

to repair submarine cables.[77] Finlayson also collaborated with the Marine Technology Support Unit at Wantage Research Laboratory, part of the United Kingdom Atomic Energy Authority, on developing underwater habitats in which engineers could repair submarine cables.[78] The Post Office never established a diving unit and apparently never deployed submersible habitats, but its interest in these strategies highlights the pressure to devise new ways of quickly repairing damaged cables. One successful strategy was the use of submersibles. In the early 1970s, the Post Office used manned submersibles, called Pisces, to bury and repair cable, and later used two remotely controlled submersibles, known as SCARABs, for submarine maintenance work.[79] Another Post Office project developed a new grapnel for cutting deep-sea cables and bringing them to the surface for repairs. By 1979, Martlesham Heath had developed the "cut and hold grapnel," which could simultaneously cut a cable and lift it for repairs. The grapnel could work at depths of 5,000 fathoms, had a sonar surveillance system, and used a built-in power source to provide hydraulic operation. This new grapnel reduced grappling time by one-third and total repair time by just over one-fifth and was heralded as a leap forward in cable repair, quickly finding customers abroad.[80]

The maintenance of submarine cables required close cooperation and collaboration among North Atlantic telecommunications companies, which paved the way for more organized resistance by AT&T and the European PTTs, which favored cables, against INTELSAT. In 1975, a consortium of North Atlantic telecom companies, including the Post Office and AT&T, signed the North Atlantic Cable Maintenance Agreement, to pool funds and share resources over cable maintenance, beginning with the purchase of the SCARAB remotely controlled submersibles. The technical and diplomatic considerations that influenced cable planning, as well as the benefits of pooling resources, demonstrated by arrangements such as the North Atlantic Cable Maintenance Agreement, meant that, in 1977, the Post Office hosted the first North Atlantic Systems Conference.[81] The conference, composed of telecom administrations from Western Europe and North America, met in Eastbourne, Sussex, and was ostensibly transmission-neutral, claiming to discuss all communication links across the North Atlantic. As such, the conference also invited representatives from COMSAT and INTELSAT.

The telecom administrations, however, had an ulterior motive of reestablishing cables' place in transatlantic communications. In 1976, AT&T and the Post Office, along with CTNE, the Spanish telephone administration,

discussed developing the next round of transatlantic cables, TAT-7 and TAT-8.[82] AT&T had found it challenging to secure FCC approval for transatlantic telephone cables, given the US commitment to communication satellites and the security of the COMSAT-INTELSAT diplomatic and legal instrument. The telecom companies thus aimed to give transatlantic telephone cable planning greater weight in the FCC's eyes. The result was the North Atlantic Systems Conference, which earned legitimacy by claiming system neutrality and having COMSAT and INTELSAT as participants. Somewhat too late, COMSAT's representative, Jack Oslund, realized that the conference was, in his words, an attempt to "INTELSATIZE the cable planning process to achieve a comparability with the satellite process in the eyes of the US government," by which he meant the FCC.[83] By this point, however, plans for TAT-7 had been approved, the groundwork for TAT-8 laid, and agreements made by the North American and European telecom companies for further conferences in the series.

In 1978, TAT-7, the last analogue coaxial cable in the TAT series, was laid, and ten years later, in 1988, TAT-8, the first digital fiber-optic cable, was laid. TAT-8 was a joint venture led by the newly privatized BT, the newly divested AT&T, and France Télécom, created in 1988 in preparation for the French separation of posts and telecoms, which in turn paved the way for liberalization and privatization. The cable cost £225 million, of which BT contributed £34 million, the second-largest share. The cable's novelty lay not just in its new transmission medium, optical fiber, nor its new digital transmission mode, but also its use of an underwater branching unit on the continental shelf off the British coast. This meant that the cable provided links from the United States to both Britain and France, as well as a cross-channel fiber-optic link.[84] TAT-8 could carry forty thousand simultaneous telephone calls, which was almost a tenfold leap over TAT-7's 4,200-circuit capacity and more than a threefold increase from the most recent INTELSAT series, INTELSAT V, which could carry twelve thousand calls.[85]

TAT-7 and TAT-8 arrived during a crucial period in the Post Office and AT&T's attempts to break INTELSAT's dominance over transatlantic communications. This became an especially important goal for AT&T and the Post Office as their own regulatory frameworks transformed. In 1982, the US federal government broke up AT&T's monopoly, requiring that AT&T divest its local networks into independent regional subsidiaries. In 1981, meanwhile, the Post Office became British Telecom, had its domestic monopoly turned

into a duopoly, and then was privatized in 1984. Both, however, maintained their international services and networks, and deregulation encouraged them to expand further into the lucrative international telecommunications market. This came at a time when both the US and British governments joined AT&T and BT in wanting to see an end to INTELSAT's satellite monopoly over transatlantic communications.[86] The British government wanted to increase BT's appeal to international business users and believed that undermining INTELSAT might open up opportunities for British aerospace manufacturers, which historically had little success in securing contracts to supply INTELSAT. The US government, meanwhile, had seen its majority stake in INTELSAT declining as more and more countries had joined INTELSAT through the 1970s. Furthermore, INTELSAT's demand for communications satellites could not keep up with the supply capacity of the US aerospace industry, so liberalizing satellite communications would also benefit US satellite manufacturers.

In 1985, the FCC thus made several decisions that broke INTELSAT's dominance. In addition to authorizing TAT-8, the FCC approved further private transatlantic fiber-optic cables from new suppliers Tel-Optik and Submarine Lightwave. But, in perhaps the most surprising decision, the FCC also approved an application from Orion Satellite Corporation to place a private communications satellite over the Atlantic. In total, the FCC approved 330,000 circuits for transatlantic communications, more than tripling Intelsat's then-capacity of 100,000.[87] While the FCC's approval of the Orion satellite signaled a formal end to INTELSAT's transatlantic monopoly, the Post Office, AT&T, and other North Atlantic telecom operators had already successfully resisted this monopoly since the mid-1970s by INTELSAT-izing cable planning, so securing the FCC's approval of TAT-7.

Furthermore, while Orion was the first private satellite over the Atlantic, BT had already begun a service, SatStream, that showed how satellite liberalization could circumvent existing domestic monopolies. SatStream was an international data service that allowed customers to connect directly with each other via rooftop satellite dishes, which transmitted the signal from one rooftop, via an INTELSAT satellite, to another rooftop satellite dish. BT launched this service in 1984 to connect businesses in Canada, the UK, and Europe and called it an "integral part of British Telecom's network market strategy" as BT searched for new clients to remain competitive after liberalization.[88] Because SatStream was effectively a rooftop-to-rooftop service, it bypassed domestic telecom networks in Canada and Europe. This meant

that BT's SatStream clients did business only with BT, which leased the satellite lines from INTELSAT, rather than having to route their traffic via their domestic telecom provider to a satellite earth station. SatStream was not a commercial success—by 1986, BT only had one SatStream customer—but it was an important proof-of-principle that the liberalization of satellite communications could be used to bypass domestic telecom monopolies.[89]

BT was, in effect, using satellites to evade the monopolies of its fellow European PTTs, possibly inspiring Orion's proposal to the FCC in 1985, which further privatized and liberalized transatlantic satellite communications.[90] BT's new network market strategy of prioritizing international business customers was also apparent in another development, London Teleport, an urban satellite earth station that opened for service on February 1, 1984, in London Docklands to bring "high-speed telecommunications to the fingertips of the City" using the City of London's new fiber-optic network.[91] Announcing that it was "bringing space-age communications to the heart of London," BT emphasized the teleport's business orientation by highlighting its videoconferencing capabilities, offering "the busy executive the ability to conduct real time, face-to-face meetings without the need to commit valuable time and resources to travel." These developments, especially SatStream, show how BT found new technologies, both cables and satellites, that could help it liberalize the regulation of transatlantic communications, just as the Post Office had done thirty years earlier with TAT-1.

BT made this a priority because of the massive expansion of international data communications markets, and both BT and AT&T showed this in their advertising to business customers. These ads underscored the importance of these international data communications markets by linking satellites, information technology, and international business. The BT International and AT&T ads mentioned above demonstrate how these corporations juxtaposed satellites, computers, and business, all in the same year that TAT-8 launched. In 1984, another BT International ad told customers that international communication was "uniting the business world," while a 1986 ad announced that international videoconferencing was businesses' "short cut to the global village," recasting McLuhan's concept of the global village into a capitalist vision of globalism.[92] Another 1986 ad publicized global data communication links as "The Information World."[93] AT&T's advertising in the 1980s also reflected this, presenting AT&T as "The Knowledge Business" and that, through its international services, "Bell Brings the World Closer."[94] A series of

ads addressing AT&T's divestiture linked international services explicitly to the information age. In one, AT&T's CEO of overseas services, Morris Tanenbaum, explained that AT&T's global network was "the foundation for the information age."[95] This paralleled the AT&T TV ad described at the beginning of this chapter, in which AT&T promoted its "worldwide intelligent network." In a 1986 ad, "Issues of the Information Age: Promises Kept, Promises to Keep," which ran in the *Wall Street Journal*, AT&T explained how international communications was key to achieving a worldwide "Telecommunity," a "vast global network of networks, the merging of computers and communications."[96] This emphasis on satellites and data communications was not exactly new. Satellites had been described as a key information technology, heralding an "information revolution," by economists since the 1960s.[97] But what both BT and AT&T showed was that, in a world of expanding data communications, the economic importance of both satellites and cables was, for them, in how they could further the privatization and liberalization of international communications.

CONCLUSION

From the 1950s to the 1980s, the Post Office, BT, and AT&T developed new satellite and cable systems to increase their share of the revenue generated by transatlantic communications, and this shaped and was shaped by both international and domestic telecom liberalization. In the 1950s and early 1960s, the national monopolies of the Post Office and AT&T pioneered two new transatlantic communications systems, TAT-1 and Telstar. TAT-1 already showed how the Post Office used new coaxial technology, capable of simultaneously transmitting telegraphy and telephony, to take international telegraph markets away from US international record carriers. But transatlantic cables were soon overtaken by satellites. As satellites emerged, the Post Office worked at the 1963 Extraordinary Administrative Radioconference to advance a complementary communications agenda that favored connecting cables and satellites. Cold War interests motivated the US-led construction of a worldwide satellite system, taking shape as INTELSAT, while national telecom monopolies pursued various organizational and environmental strategies to safeguard cables' futures.

This led to a "battle of the systems" between INTELSAT's global system of geostationary satellites and the North Atlantic cable system. INTELSAT institutionalized Cold War satellite techno-diplomacy as part of the US

foreign policy agenda. Meanwhile, North Atlantic telecom monopolies, led by the Post Office and AT&T, developed new forms of corporate partnerships to protect cables, leading to the "INTELSAT-izing" of North Atlantic cables to mirror satellite planning, successfully securing approval for TAT-7. This culminated in the liberalization of transatlantic communications in the mid-1980s. INTELSAT lost its monopoly over satellite communications and TAT-8, the first digital, fiber-optic, transatlantic cable tilted communications in favor of cables. New satellite technologies, such as London Teleport and SatStream, also shifted international communications away from domestic monopolies and toward those international service providers, among which BT could count itself, that could provide services circumventing domestic networks.

But this was more than a history of technology, of satellites and cables. The environments of these technologies were also key. In the 1950s and early 1960s, both AT&T and the Post Office presented themselves as conquering the oceanic and space environments on behalf of their nations. The Post Office used TAT-1 and Goonhilly to emphasize British technological mastery over the environment, while in the US, AT&T highlighted TAT-1 and Telstar's hazardous ocean and space environments to accentuate its contributions to the projection of US military and economic interests abroad. Once satellites began competing with cables, satellite organizations like INTELSAT and COMSAT wielded "one world" discourses and the environment as rhetorical devices to bludgeon cables, emphasizing cables' fragility and satellites' global and environmental transcendence. Meanwhile, the Post Office and AT&T worked on new technologies, from sea-ploughs to submersibles, to protect and maintain undersea cables. These strategies were not purely technological either, as new transnational corporate partnerships took form in the North Atlantic Cable Maintenance Agreement and the North Atlantic Systems Conference to defend and promote cables. Here, the environmental history of cable maintenance was an important foundation for the corporate partnerships that successfully opposed INTELSAT.

In the 1980s, however, the environment became much less visible in discourses around transatlantic communications. AT&T and BT, as newly denationalized telecom corporations, articulated a new information age discourse oriented to global capital. In this discourse, transatlantic communication was instantaneous and dematerialized. Satellites also became the preeminent symbol of global communications, no longer a communications technology but an "information technology," juxtaposed with computers to

perpetuate the idea of satellites as the key transnational technology of the information age. AT&T and BT's advertising fused space age and information age discourses so that their international business clientele would see the world through the lens of a satellite.

This history also shows how new transatlantic communications technologies were used to build monopolies and markets in ways that complicate traditional narratives of the "market turn." Such a traditional narrative would point to the FCC's 1985 decision, during the Reagan administration, to liberalize satellite communications as a classic example of a monopoly, INTELSAT, being turned into a market. So too do AT&T's divestiture and BT's liberalization show how domestic deregulation meant that these corporations could compete more on international markets. Or, in the wider, global history of the market turn, broader international regulatory changes, like the General Agreement on Tariffs and Trade, especially the 1973–1979 Tokyo Round of negotiations, seemed to provide regulatory frameworks that facilitated the rise of neoliberalism.[98] But to focus only on these institutional arrangements would miss how, since the 1950s, the Post Office and AT&T had used submarine cables to disrupt the regulation of international communications. For the Post Office, TAT-1 was an opportunity to disrupt the FCC's separation of international telephony and telegraphy. During the 1970s, before their monopolies were deregulated, the Post Office, AT&T, and other North Atlantic telecom companies used their transnational corporate partnerships to fight INTELSAT's monopoly.

In short, this history shows that the Post Office, BT, and AT&T used the infrastructure of transatlantic communications to pressure for deregulation from the bottom up. It was infrastructural change, both in the form of new technologies, such as coaxial cables and communication satellites, and in the form of corporate partnerships, that mattered, rather than ideological change. In this light, liberalization and privatization were not ruptures but showed continuities on either side. The Post Office was increasingly focused on corporate markets beforehand and continued so as BT afterward. All throughout this history, the Post Office and BT's business customers played an influential role in motivating the search for cheaper transatlantic communications and deregulated international telecom markets. The next chapter focusses on those customers directly, showing how, through the 1970s, the Post Office became increasingly oriented toward London's financial sector in a relationship that would ultimately dictate BT's privatization.

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Visions of a Digital Nation

Market and Monopoly in British Telecommunications

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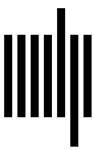

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