

No. 19-16122

IN THE
**United States Court of Appeals
for the Ninth Circuit**

FEDERAL TRADE COMMISSION,

Plaintiff-Appellee,

v.

QUALCOMM INCORPORATED, a Delaware corporation,

Defendant-Appellant,

SAMSUNG ELECTRONICS COMPANY, LTD.; SAMSUNG SEMICONDUCTOR
INC.; INTEL CORPORATION; ERICSSON, INC.; SAMSUNG
ELECTRONICS AMERICA, INC.; AND MEDIATEK INC.,

Intervenors,

NOKIA TECHNOLOGIES OY,

Intervenor.

APPEAL FROM THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA

**BRIEF OF THE R STREET INSTITUTE AS *AMICUS CURIAE* IN
SUPPORT OF PLAINTIFF-APPELLEE**

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CORPORATE DISCLOSURE STATEMENT

Pursuant to Federal Rule of Appellate Procedure 26.1, *amicus curiae* the R Street Institute states that it has no parent corporation or publicly held corporation that holds 10% or more of its stock.

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INTEREST OF *AMICUS CURIAE*

The R Street Institute¹ is a nonprofit, nonpartisan public-policy research organization. R Street’s mission is to engage in policy research and educational outreach that promotes free markets as well as limited yet effective government, including properly calibrated legal and regulatory frameworks that support economic growth and individual liberty.

SUMMARY OF ARGUMENT

National security is at stake in the present case, though not in the way that Qualcomm asserts. In considering whether Qualcomm’s scheme for licensing its mobile communications patents violates the antitrust laws, this Court should be concerned that monopolistic patent licensing can, and historically did, interfere with national security. By contrast, greater competitiveness tends to boost national security, in terms of both cybersecurity and technological superiority against competitor nations such as China. A failure to enforce the competition laws fully would thus be, as former Secretary of Homeland Security Michael Chertoff put it, “a self-inflicted wound to U.S. national interests.”

¹Pursuant to Federal Rule of Appellate Procedure 29(a), all parties consent to the filing of this brief. Pursuant to Rule 29(c)(5), no counsel for a party authored this brief in whole or in part, and no person or entity, other than *amicus*, its members, or its counsel, made a monetary contribution to the preparation or submission of this brief.

1. Competition improves national security along an important dimension: cybersecurity. Competition induces firms to make technology products less vulnerable to hacking and intrusion, since cybersecurity is a sellable value-add that competitors can use to gain an edge. It furthermore encourages a diversity of alternative products, avoiding “monocultures” that are especially susceptible to catastrophic, large-scale cyberattacks. Enhanced competition is thus complementary to national security, not contrary to national security as Qualcomm posits.

2. By contrast, monopolistic patent licensing has historically bottlenecked important national security interests, as seen in situations as diverse as World War I torpedo technology, early aviation, the post-9/11 anthrax bioterrorism threat, and recent defense appropriation legislation. These all show how patent owners’ efforts to dominate markets and maximize profits harmed American security by entangling mission-critical technologies, stifling downstream innovation, and forcing hard dilemmas upon the government. History thus teaches the serious consequences of giving monopoly-positioned firms, such as Qualcomm, free rein to assert their patents as aggressively as possible.

3. Strong competition also ensures America’s leading place in technological races against nations such as China. Economic research confirms the obvious: Competition, not monopoly dominance, drives innovation. If the United

States is to outdo China in critical technologies such as 5G mobile communications, artificial intelligence, and quantum computing, domestic policy must foster competition, not monopoly “national champions.”

In light of this extensive evidence of the close tie between strong competition and strong national security, Qualcomm’s opposing view is remarkable. The company and its supporters, including the Department of Defense and other federal agencies, contend that the United States is so dependent on Qualcomm’s dominant position in mobile communications technologies that this Court should take no action that “inappropriately reduces Qualcomm’s revenue substantially.”

The facts tell a different story. They show the dangers of placing the nation’s trust in a single firm to develop a critical technology. They show that private interests in maximizing patent licensing royalties do not always align with the national interest. And they show that the national security concern should be whether defense technologies are strong and competition-tested, more so than whether any company’s revenues may be “inappropriately reduced.” By affirming the decision of the district court, this Court will thus not only promote competition within the United States, but will also safeguard the nation’s security.

ARGUMENT

NATIONAL SECURITY FAVORS ENFORCEMENT OF THE COMPETITION LAWS TO PREVENT MONOPOLISTIC PATENT LICENSING

I. ROBUST COMPETITION BEST PROTECTS THE NATIONAL SECURITY INTEREST IN STRONG CYBERSECURITY

Strong competition can complement national security by enhancing domestic cybersecurity. By creating incentives to remove software vulnerabilities and reducing the incidence of “monocultures,” competition enhances the security of the United States in the online sphere. Thus, as former Secretary of Homeland Security Michael Chertoff wrote recently, “We need competition and multiple providers, not a potentially vulnerable technological monoculture,” to guarantee national security.²

A. MONOPOLY POWER CAN FOSTER TECHNICAL VULNERABILITIES, WHICH ARE ESPECIALLY HARMFUL IN SECURITY-SENSITIVE INDUSTRIES

Competition enhances national security by reducing the incidence of technical vulnerabilities. That effect is especially important for security-sensitive systems such as mobile telecommunications.

Intuitively, a causal chain from competition to cybersecurity makes logical sense. Computer security is a value-added benefit to consumers, so firms in com-

²Michael Chertoff, *Qualcomm’s Monopoly Imperils National Security*, WALL ST. J., Nov. 25, 2019, at A17, *available online*. Locations of authorities available online are shown in the Table of Authorities.

petitive markets are likely to use security to gain an edge over their competitors.³ In monopolized markets, though, there may be less external impetus to test products for flaws, and the monopolist may choose to focus less on security and more on new product features or increased product quality.

Economic research confirms that competition leads to better cybersecurity. A 2009 empirical study of web browsers considered the impact of market concentration on the amount of time that vendors took to fix security vulnerabilities as they were discovered.⁴ The study found that the presence of more competitors correlated with faster cybersecurity response—a reduction of 8–10 days in response time per additional market rival.⁵ Similarly, business researchers in 2005 modeled incentives for firms to engage in sharing of cybersecurity information, and concluded that the “inclination to share information and invest in security technologies increases as the degree of competitiveness in an industry increases.”⁶ Another study found that, where two software firms are in competi-

³See Sadegh Farhang et al., *An Economic Study of the Effect of Android Platform Fragmentation on Security Updates*, 22 INT’L CONF. ON FIN. CRYPTOGRAPHY & DATA SECURITY 119, 127 (2018) (theorizing that in competitive software markets, “when consumers take into account security, then vendors have to invest to improve their security quality”).

⁴See Ashish Arora, Chirs Forman, Anand Nandkumar & Rahul Telang, *Competition and Patching of Security Vulnerabilities: An Empirical Analysis*, 22 INFO. ECON. & POL’Y 164, 165 (2010).

⁵See *id.* at 175.

⁶Esther Gal-Or & Anindya Ghose, *The Economic Incentives for Sharing Security Information*, 16 INFO. SYSTEMS RES. 186, 188 (2005).

tion, at least one will be willing to take on some degree of risk and responsibility for cybersecurity, whereas a monopoly software firm will consistently fail to accept such responsibility.⁷ To be sure, an unpublished study from 2017 found that some market concentration can make firms more responsive to cybersecurity issues, but only to a point: “being in a dominant position reduces the positive effect of having less competitors on the responsiveness of the vendor,” and indeed the “more dominant the firm is, the less rapid it is in releasing security patches.”⁸ This research confirms that competition is more conducive to cybersecurity.

These concerns apply to the facts of the present case. Qualcomm’s control over the mobile handset industry, stemming from its dominance in the CDMA and LTE chip markets, likely diminishes its incentives to respond to vulnerabilities in its chips, share information about cybersecurity practices and issues, and take responsibility for security matters. Indeed, Qualcomm’s chips have had their share of cybersecurity failures already.⁹ The best way to flush out ongoing and

⁷See Byung Cho Kim, Pei-yu Chen & Tridas Mukhopadhyay, *An Economic Analysis of the Software Market with a Risk-Sharing Mechanism*, 14 INT’L J. ELECTRONIC COM. No. 2, at 7, 9 (2009).

⁸Arrah-Marie Jo, *The Effect of Competition Intensity on Software Security—An Empirical Analysis of Security Patch Release on the Web Browser Market* 3 (Dec. 2017) (unpublished manuscript), *available online*.

⁹See, e.g., Lucian Armasu, *Qualcomm Firmware Vulnerabilities Expose 900 Million Devices, Including Security-Focused Smartphones*, TOM’S HARDWARE (Aug. 9, 2016), *available online*; Ralf-Philipp Weinmann, *Baseband Attacks: Remote Exploitation of Memory Corruptions in Cellular Protocol Stacks 2*, in 6 PROC. USENIX WORKSHOP ON OFFENSIVE TECHS. (2012), *available online*.

future cybersecurity issues is to maintain competitive pressure at all levels of the supply chain.

B. A “MONOCULTURE” RESULTING FROM SINGLE-FIRM DOMINANCE IS ESPECIALLY VULNERABLE TO CATASTROPHIC CYBERATTACK

A second reason why monopoly undermines cybersecurity is that monopoly leads to a “monoculture” of single-vendor products, opening the door to massive systemic failure in the case of a cyberattack. Computer researchers developed the theory of software monocultures in the early 2000s, in response to the regular phenomenon of computer viruses and other attacks spreading rapidly by exploiting flaws in the dominant operating system at the time, Microsoft Windows.¹⁰ Where a computer system such as Windows has a commanding share of users, a virus that exploits a flaw in that system can quickly spread to infect a whole interconnected ecosystem. An operating system monopoly thus enables fast and easy spread of cyberattacks, and better cybersecurity would be achieved through greater diversity in online systems.¹¹ As one research group posited, “a network architecture that supports a collection of heterogeneous network ele-

¹⁰See, e.g., Daniel E. Geer Jr., *Monoculture: Monopoly Considered Harmful*, IEEE SECURITY & PRIVACY, Nov.–Dec. 2003, *available online*.

¹¹See *id.*

ments for the same functional capability offers a greater possibility of surviving security attacks as compared to homogeneous networks.”¹²

There has been considerable study of the theory that computer monocultures are naturally vulnerable to attacks. Software substitutes from competing firms generally do not share the same flaws: Of 2,627 software vulnerabilities reported in 2007, only 29 (1.1%) applied to two products providing the same functionality.¹³ By contrast, different versions of a single software product were found to share vulnerabilities 84.7% of the time.¹⁴ Thus, software monocultures share exploitable flaws even when there is some variation in versions across the monoculture; by contrast, diversity in software is almost guaranteed to prevent a single flaw from affecting all users.

In the case of a Qualcomm monopoly in the relevant mobile chip market, monoculture is an especially concerning possibility. Heavy reliance on mobile communications means that a widespread attack could have devastating consequences, potentially blacking out a region and affecting essential services such as

¹²Yongguang Zhang, Harrick Vin, Lorenzo Alvisi, Wenke Lee & Son K. Dao, *Heterogeneous Networking: A New Survivability Paradigm*, 2001 PROC. WORKSHOP ON NEW SECURITY PARADIGMS 33, 34.

¹³See Jin Han, Debin Gao & Robert H. Deng, *On the Effectiveness of Software Diversity: A Systematic Study on Real-World Vulnerabilities*, 6 PROC. INT’L CONF. ON DETECTION INTRUSIONS & MALWARE & VULNERABILITY ASSESSMENT 127, 133–34 (2009).

¹⁴See *id.* at 140.

911.¹⁵ A monoculture of chips could also enable mass surveillance or spying on citizens' mobile communications by private hackers or foreign governments.¹⁶ More robust competition, spurred by a termination of Qualcomm's anticompetitive practices, would mitigate these possibilities.

The monoculture theory is not without critics, but a review of their criticisms show them to be inapplicable to the mobile communications situation. Some suggest that software diversity imposes unwarranted costs on firms, which must forego economies of scale and devise seemingly duplicative yet different setups of computer systems.¹⁷ But those concerns largely focus on the situation where a single firm produces and manages the heterogeneous systems, and are avoided where heterogeneity arises naturally through competition among unrelated firms. Critics also argue that technological measures can create "artificial diversity" through automated randomization of software code, rendering

¹⁵See David Moore et al., *Inside the Slammer Worm*, IEEE SECURITY & PRIVACY, July–Aug. 2003, at 33, 37.

¹⁶Cf. Devlin Barrett, *Americans' Cellphones Targeted in Secret U.S. Spy Program*, WALL ST. J., Nov. 13, 2014, *available online* (discussing technology for surveillance of cell phone calls enabled by a flaw in mobile chip security); Heath Hardman, *The Brave New World of Cell-Site Simulators*, 8 ALB. GOV'T L. REV. 1 (2015).

¹⁷See, e.g., Randal C. Picker, *Cybersecurity: Of Heterogeneity and Autarky*, in THE LAW AND ECONOMICS OF CYBERSECURITY 115, 125 (Mark F. Grady & Francesco Parisi eds., 2005). Picker proposes "autarky," namely self-sufficiency of computers so that they can be disconnected from networks, as an alternative solution to monoculture. That proposal obviously is unworkable for mobile phones.

competition-driven diversity unnecessary.¹⁸ But even these critics acknowledge that artificial diversity techniques are often insufficient because those techniques depend on assumptions about what aspects of the technology are most likely vulnerable to attack; indeed, the critics concede that artificial diversity cannot stop attacks involving operation of legitimate software functions in undesirable ways (sending spam emails or deleting document files, for example).¹⁹

Monoculture is unavoidable in at least one respect: All mobile chips, whether Qualcomm's or others', must conform to technical standards such as CDMA, 4G LTE, or 5G. A flaw in the standards themselves would render all mobile devices vulnerable to an identical attack. The best defense against this especially catastrophic possibility is rigorous development and testing of standards like 5G. And the best way to ensure rigorous development and testing is to ensure that as many firms as possible, especially firms that share American values, are involved in the development of 5G and other standards.²⁰ The necessary standardization of mobile communications, then, is perhaps the most important reason why a competitive market is essential to cybersecurity and national security.

¹⁸See Fred B. Schneider & Kenneth P. Birman, *The Monoculture Risk Put into Context*, IEEE SECURITY & PRIVACY, Jan.–Feb. 2009, at 14, 15.

¹⁹See *id.* (discussing “interface attacks”).

²⁰*Cf.* United States 5G Leadership Act of 2019, S. 1625, 116th Cong. § 9(a) (May 22, 2019).

II. AGGRESSIVE PATENT LICENSING HAS POSED MULTIPLE GRAVE RISKS TO AMERICAN NATIONAL SECURITY

On multiple occasions throughout history, patent licensing has intersected with national security in ways that have left the United States ill-prepared to face contemporary threats. These occasions contain important lessons about the relationship among patents, competition, and national security.

To be sure, patents are important incentives for innovation that drive the development of new technologies including those that better protect Americans, and patent-holding inventors are due reasonable compensation for their inventive work. The problems have arisen not from the mere existence of patents, but from their owners' decisions to leverage them to extract as much private value as possible without concern for public consequences.

A. PATENTS ON PUBLIC-PRIVATE TECHNOLOGY LED TO AMERICAN WEAPONS SHORTAGES AND DEPENDENCE ON FOREIGN TORPEDOES

The development of the torpedo offers a useful example for the present case because it shows the dangers of the United States being dependent on a single monopoly producer of critical technology.

At the start of the 20th century, it was apparent that naval supremacy was contingent on torpedoes. A 1903 U.S. Naval War College conference report concluded, based on simulations of U.S.–German naval battles, that torpedoes “turn the scale of battle in their favor in a most decided manner” and recommended

arming ships with them.²¹ This jolted the Navy’s Bureau of Ordnance into accelerating its torpedo development work, and in particular forming a public–private partnership in 1904 with the E.W. Bliss Company and its engineer Frank M. Leavitt to develop and manufacture the then-experimental Bliss–Leavitt torpedo.²²

Unfortunately, “what was commercially valuable for the Bliss Company was not necessarily militarily valuable for the Navy,” and patent licensing became a focal point of that misalignment.²³ The Bliss Company was a licensee of key patents on the superheater, a technology for torpedo propulsion.²⁴ Bliss negotiated with the government to license those patents from 1905 through 1912, ultimately dragging the government into litigation through 1920.²⁵ Nor was the government blameless: It sought its own patent on torpedo stabilization, which further bungled the relationship between Bliss and the government.²⁶

Two problems arose, at least in part because of this patent infighting between Bliss and the government. The decades of litigation likely consumed resources from both sides that could otherwise have been put to innovation. Moreover, the patent disputes reflected a larger campaign on the part of Bliss to monopolize the

²¹KATHERINE C. EPSTEIN, *TORPEDO: INVENTING THE MILITARY-INDUSTRIAL COMPLEX IN THE UNITED STATES AND GREAT BRITAIN* 68–69 (2014).

²²*See id.* at 69–70.

²³*Id.* at 73.

²⁴*See E.W. Bliss Co. v. United States*, 253 U.S. 187, 188 (1920).

²⁵*See id.* at 189–90; EPSTEIN, *supra* note 21, at 93–94.

²⁶*See E.W. Bliss Co. v. United States*, 248 U.S. 37, 40 (1918); EPSTEIN, *supra* note 21, at 82–83.

torpedo market at the expense of the U.S. government. In 1906, Bureau head N.E. Mason wrote that “the Bureau has been handicapped by the knowledge that, due to the monopoly held by the company, the Bureau would have to accept the terms offered or get no torpedoes. The Bureau has become convinced that a belief in the helplessness of the Government has influenced the E. W. Bliss Company in its prices, deliveries and workmanship.”²⁷

Dependence on an exclusive domestic torpedo innovator would have consequences. Bliss ultimately failed to deliver on its promises for the Bliss–Leavitt torpedo and, by 1907, had to ask the Bureau to reduce the performance minimums in the contract.²⁸ Mark Bristol of the Naval Torpedo Station connected that failure to the Bliss Company’s efforts at monopolization, lecturing in 1909 that company’s “‘get rich quick’ scheme” had left it “failing to improve the turbine” such that “the Bliss–Leavitt torpedo today is inferior to the Whitehead,” its foreign competitor with close ties to the Austro-Hungarian Empire.²⁹ His obser-

²⁷EPSTEIN, *supra* note 21, at 86 (quoting letter from Mason to the Secretary of the Navy, Oct. 17, 1906).

²⁸*See id.* at 88.

²⁹*Id.* at 102. The Whitehead factory was based in Fiume (Rijeka), a naval base of the Austro-Hungarian Navy, and the torpedo was developed for the Austrian navy. *See* LAWRENCE SONDHUS, *THE NAVAL POLICY OF AUSTRIA-HUNGARY, 1867–1918*, at 47–48 (1994). Robert Whitehead, the torpedo inventor and factory namesake, was also the grandfather of Agathe Whitehead, whose famously Austrian husband was Captain Georg von Trapp.

vation is consistent with the general trend of dominant market power diminishing incentives to innovate.³⁰

With Bliss unable to make torpedoes up to spec, the Bureau in 1907 found itself forced to turn to those Austrian Whitehead torpedoes, first purchasing them and then licensing the rights to manufacture.³¹ Thus, on the eve of World War I, the U.S. Navy was “scarcely equipped to enter the war” and indeed dependent on war technology sourced from an empire that would soon be an enemy.³²

Besides showing how patent posturing can affect national security, the Bliss–Leavitt torpedo debacle highlights the dangers of American dependence on single-firm control over critical technology. It should raise alarms in the present case—concerning monopoly in critical communications technology—that a century ago, monopoly in also-critical torpedo technology nearly sunk the Navy.

B. THE WRIGHT BROTHERS’ PATENT LITIGATION CAMPAIGN RESULTED IN AMERICAN AVIATION INFERIORITY TO GERMANY

On the eve of World War I, the United States stood at a stark disadvantage to Europe in the air: The government in 1913 held 6 military airplanes to France’s 266, and a federal official lamented that the country had fallen “from first place

³⁰See *infra* pp. 26–27.

³¹See EPSTEIN, *supra* note 21, at 87 (quoting letters from Bureau head N.E. Mason to the Secretary of the Navy); Naval Service Appropriations Act, ch. 2512, § 1, 34 STAT. 1176, 1180 (1907).

³²EPSTEIN, *supra* note 21, at 103.

to last of all the great nations in the air.”³³ The root cause of this deficiency was again aggressive patent licensing, in this case instigated by no less than Orville and Wilbur Wright.

The Wright brothers are famous for solving the key lateral-roll problem of aviation;³⁴ they are infamous for aggressively litigating the resulting patent. Throughout the early 1900s, the Wrights filed multiple suits against their main competitor, airplane manufacturer Glenn Curtiss, in what the newspapers termed the “patent wars.”³⁵ They also sued foreign aviators at American exhibitions, often springing the lawsuits unexpectedly on the aviators or show exhibitors immediately after the shows.³⁶

How did airplane patent litigation contribute to America’s technological lag? The conventional theory is that the Wrights’ patent licensing demands dissuaded

³³TOM D. CROUCH, *WINGS: A HISTORY OF AVIATION FROM KITES TO THE SPACE AGE* 147 (2003).

³⁴See U.S. Patent No. 821,393 (issued May 22, 1906); *Wright Co. v. Herring–Curtiss Co.*, 204 F. 597, 600 (W.D.N.Y. 1913), *aff’d*, 211 F. 654 (2d Cir. 1914) (per curiam).

³⁵*End Patent Wars of Aircraft Makers*, N.Y. TIMES, Aug. 7, 1917, at 5; see *Wright Co v. Herring–Curtiss Co.*, 177 F. 257, 261 (C.C.W.D.N.Y. 1910) (granting preliminary injunction); *Wright Co. v. Herring–Curtiss Co.*, 211 F. 654 (2d Cir. 1914) (per curiam) (final appeal); FRED C. KELLY, *THE WRIGHT BROTHERS* 296 (Dover Publ’ns 1989).

³⁶See *Wright Co. v. Paulhan*, 177 F. 261, 271 (C.C.S.D.N.Y. 1910); Herbert A. Johnson, *The Wright Patent Wars and Early American Aviation*, 69 J. AIR L. & COM. 21, 31–33 (2004).

American firms from investing in aviation technology,³⁷ but a handful of dissenting historians reply that substantial investment in aviation was occurring in the United States.³⁸ Evaluating this disagreement is not straightforward. The dissenters are correct that there was not a total industry holdup, but it is unclear whether investment was nevertheless depressed or was falling behind investment in Europe, where for a variety of reasons patent litigation was not as prevalent.³⁹ Furthermore, there is disagreement as to whether the demanded royalties were “almost confiscatory”⁴⁰ or not,⁴¹ though it is perhaps notable that the demanded royalty is strikingly like Qualcomm’s.⁴²

³⁷ See, e.g., Johnson, *supra* note 36, at 42–43; 1 ALEX ROLAND, MODEL RESEARCH: THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS 1915–1958, at 38 (1985); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 890–91 (1990); Scott McCartney, *Wright Brothers’ Patent Battle Proved Costly in Aviation Race*, WALL ST. J. (Dec. 17, 2003), *available online*; Phaedra Hise, *How The Wright Brothers Blew It*, FORBES (Nov. 19, 2003), *available online*.

³⁸ See Tom D. Crouch, *Blaming Wilbur and Orville: The Wright Patent Suits and the Growth of American Aeronautics*, in *ATMOSPHERIC FLIGHT IN THE TWENTIETH CENTURY 290–91* (Peter Galison & Alex Roland eds., 2000); Ron D. Katznelson & John Howells, *The Myth of the Early Aviation Patent Hold-up—How a US Government Monopsony Commandeered Pioneer Airplane Patents*, 24 INDUS. & CORP. CHANGE 1, 11–13 (2014).

³⁹ See Johnson, *supra* note 36, at 25; Christine MacLeod, *Reluctant Entrepreneurs: Patents and State Patronage in New Technosciences, Circa 1870–1930*, 103 ISIS 328, 337 (2012).

⁴⁰ See LAWRENCE GOLDSTONE, *BIRDMEN: THE WRIGHT BROTHERS, GLENN CURTISS, AND THE BATTLE TO CONTROL THE SKIES* 203 (2014).

⁴¹ See Katznelson & Howells, *supra* note 38, at 33–34.

⁴² The Wright–Martin company demanded 5–10% on gross receipts (not net profits) of finished products (not the smallest salable patent-practicing unit) on all

A better explanation is a lack of “knowledge spillovers.” Economists posit that much innovation in and across industries occurs when researchers are in close proximity with each other, such that knowledge can informally “spill over” within the community and particularly within countries.⁴³ The spillover effect is most prominent when the community contains a diversity of innovators, such that “local competition promotes growth.”⁴⁴

In view of this economic theory, it becomes apparent that a driving cause of the lack of aviation innovation in the United States was a lack of knowledge spillovers stemming from the Wrights’ patent litigation. The result of their suing foreign aviators and enjoining aviation exhibitions was that “all the foreign aviators of note have assured that they will not sign contracts to appear” in the United States while litigation was pending.⁴⁵ And the ongoing, bitter litigation between Curtiss and the Wrights meant that two of the most powerful American

airplane-related products (not just those using the patent) including accessories, instruments, training school tuition, and flight show tickets. *See Application for License and Form of Agreement of the Wright–Martin Aircraft Corporation*, in 54 CONG. REC. 3238 (1917); *cf. Fed. Trade Comm’n v. Qualcomm Inc.*, No. 17-cv-220, slip op. at 6–8 (N.D. Cal. May 21, 2019). All this was stacked on top of whatever royalty Curtiss intended to demand. *See Makers Must Buy a Curtiss License*, N.Y. TIMES, Dec. 20, 1916, at 14.

⁴³See Adam B. Jaffe et al., *Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations*, 108 Q.J. ECON. 577, 578 (1993).

⁴⁴Edward L. Glaeser et al., *Growth in Cities*, 100 J. POL. ECON. 1126, 1129 (1992).

⁴⁵*Foreign Aviators Shy of Infringement Suits on Aeroplane Patents in America*, BOSTON SUNDAY GLOBE, Mar. 13, 1910, at 11; *see* GOLDSTONE, *supra* note 40, at 200.

innovators were essentially out of commission for years.⁴⁶ Without a robust influx of experts and technologists, innovation could not occur in the United States at the same rate as in Europe, which by 1910 had outstripped the United States in airplane motor and wing design.⁴⁷ Thus, “the Wrights virtually isolated American aviation from knowledge of rapid European improvement of airplane design and manufacture.”⁴⁸

Indeed, even one of the dissenting historians appears to support this knowledge spillover issue. “Strenuous competition between a relatively large number of designers and aviators in Europe,” Dr. Tom D. Crouch explains, “led to the exploration of a wide range of configurations, the use of new materials, and improved control systems and power plants.”⁴⁹ By contrast, American aviators “had not been tested under the constant pressure to fly higher, faster and farther against a wide range of competitors,” leaving them and American airplane manufacturers “largely committed to the original configuration of the Wright airplane” and with “little incentive to change.”⁵⁰ Crouch concludes that the greater prevalence of air shows and exhibitions in Europe drove this competitive pres-

⁴⁶See GOLDSTONE, *supra* note 40, at 236.

⁴⁷See *id.* at 236–37.

⁴⁸Johnson, *supra* note 36, at 31.

⁴⁹Crouch, *supra* note 38, at 292–93.

⁵⁰*Id.* at 292.

sure toward innovation,⁵¹ but overlooks the fact that the dearth of air shows in the United States was a direct result of patent litigation.

This knowledge spillover problem should cast a long shadow over this case. Much like the Wright brothers, Qualcomm uses a dominant position and aggressive patent licensing to keep the industry under its thumb. That level of control likely denies the United States the advantage of innovative collaborations and knowledge spillovers in the modern telecommunications market, just as it appears to have done in the early aviation market. Indeed, Qualcomm's patent litigation arguably contributed to the loss of a key American 5G innovator, Intel.⁵² Allowing market concentration to clog the knowledge spillover pathway to innovation could thus deny American superiority in key technologies today, just as it did a century ago.

C. DRUG PATENT BRINKMANSHIP THREATENED TO DEPRIVE THE PUBLIC OF PROTECTION FROM TERRORIST ANTHRAX ATTACKS

Aggressive patent licensing imperiled national security again in 2001 by jeopardizing the ability of the United States to protect the public from threats of bioterrorism.

⁵¹*See id.*

⁵²*See* Chaim Gartenberg, *Intel Says Apple and Qualcomm's Surprise Settlement Pushed It to Exit Mobile 5G*, THE VERGE (Apr. 25, 2019), *available online*.

In the wake of the September 11 attacks, there was an immediate and credible threat of a mass attack of weaponized anthrax immune to traditional antibiotics.⁵³ Defending against this threat required a stockpile of treatments ready to deploy in cities of millions blanketed with airborne anthrax spores.⁵⁴ At the time, only one treatment was approved to treat anthrax: ciprofloxacin, or Cipro, an antibiotic manufactured—and patented—by Bayer.

Two problems arose out of Bayer's patent. First, Bayer's prices for the drug were exceptionally high—35 times the cost of identical generics.⁵⁵ Second and more problematic was Bayer's own production capacity. The government estimated it would need a stockpile of 60 days' treatment for 12 million people.⁵⁶ Generic manufacturers estimated they could fill that need in 3 months, but Bayer determined that its own factories would require "20 months, working 24 hours a

⁵³See *Effective Responses to the Threat of Bioterrorism: Hearing Before the Subcomm. on Public Health of the S. Comm. on Health, Education, Labor, and Pensions*, 107th Cong. 5 (Oct. 9, 2001) (statement of Sen. Bill Frist); Elisabeth Bumiller, *Public Health Or Public Relations*, N.Y. TIMES, Oct. 21, 2001, § 4, at 4, *available online*.

⁵⁴See OFFICE OF TECH. ASSESSMENT, OTA-ISC-559, PROLIFERATION OF WEAPONS OF MASS DESTRUCTION: ASSESSING THE RISKS 54 fig.2-2 (Aug. 1993), *available online*.

⁵⁵See Donald G. McNeil Jr., *A Rush for Cipro, and the Global Ripples*, N.Y. TIMES, Oct. 17, 2001, at A1, *available online*.

⁵⁶See Elisabeth Bumiller, *Administration Won't Allow Generic Versions of Drug*, N.Y. TIMES, Oct. 18, 2001, at B8, *available online*. Some saw this as an underestimate. See Keith Bradsher & Edmund L. Andrews, *U.S. Says Bayer Will Cut Cost of Its Anthrax Drug*, N.Y. TIMES, Oct. 24, 2001, at B7, *available online*.

day” to fulfill the requisition.⁵⁷ Nevertheless, Bayer refused to permit generics to manufacture the drug.⁵⁸

Bayer’s stance left the Bush administration torn between honoring the company’s patent and readying for a mass anthrax disaster. On the one hand, the government could have invoked its powers under 28 U.S.C. § 1498(a) to allow generic entry at the cost of “reasonable and entire compensation.” But “breaking” Bayer’s patents would have been globally hypocritical in light of the government’s arguments that South Africa could not do the same to patents on AIDS treatments.⁵⁹ On the other hand, it would have been no less hypocritical for the government to leave the American public unprotected, given that it had been giving Cipro to White House staff as of September 11.⁶⁰

The Health and Human Services Department initially avoided invoking § 1498, hoping to negotiate a deal between Bayer and the generic manufacturers.⁶¹ But as political pressure mounted, HHS changed course and prepared to call for legislation circumventing Bayer’s patent, forcing Bayer into a concession

⁵⁷Bumiller, *supra* note 56.

⁵⁸*See id.*

⁵⁹*See* McNeil, *supra* note 55; Sabin Russell, *U.S. Push for Cheap Cipro Haunts AIDS Drug Dispute*, S.F. CHRON., Nov. 8, 2001, at A13, *available online*; *see also* Lauren Keller, *Ciprofloxacin and Compulsory Licensing of Pharmaceutical Patents 12–13* (Apr. 23, 2002) (unpublished third-year paper), *available online*.

⁶⁰*See* Sandra Sobieraj, *White House Mail Machine Has Anthrax*, WASH. POST (Oct. 23, 2011), *available online*.

⁶¹*See* Vanessa Fuhrmans, *Bayer May Ask Its Rivals for Help Producing Anthrax Antibiotic Cipro*, WALL ST. J. (Oct. 18, 2001), *available online*; Robert Pear, *Gov-*

of selling Cipro to the government at a fire-sale 50% discount.⁶² Though HHS denied doing so in its public comments, Bayer's subsequent investor statements suggest that HHS did leverage its § 1498 powers to induce the deal.⁶³

Throughout and after this patent squabble, Bayer and its supporters contended that the high patent-based prices for Cipro were necessary innovation incentives, not a profit-maximizing overcharge at the expense of the public.⁶⁴ Subsequent facts told otherwise. Two years later, in 2003, Bayer would plead guilty to Medicaid fraud and pay a \$257 million fine for a five-year-long scheme of overcharging the government for Cipro.⁶⁵

ernment Talks with Drug Companies About Buying Antibiotics That Treat Anthrax, N.Y. TIMES, Oct. 20, 2001, at B8, *available online*.

⁶²See Keith Bradsher, *Bayer Agrees to Charge Government a Lower Price for Anthrax Medicine*, N.Y. TIMES, Oct. 25, 2001, at B8, *available online*; *Bayer Agrees to Cut Cipro Price for Government After Administration Threatens to Override Patent*, KAISER HEALTH NEWS (June 11, 2009), *available online*.

⁶³*Compare Nomination of Alex Michael Azar II: Hearing Before the S. Comm. on Finance*, 115th Cong. 119–20 (2018), *available online*, with Bayer AG, Registration Statement (Form 20-F), at 10 (June 24, 2002), *available online*.

⁶⁴See James Surowiecki, *No Profit, No Cure*, NEW YORKER (Oct. 29, 2001), *available online*; Matthew Herper, *Cipro, Anthrax And The Perils Of Patents*, FORBES (Oct. 17, 2001), *available online*; Daniel R. Cahoy, *Treating the Legal Side Effects of Cipro: A Reevaluation of Compensation Rules for Government Takings of Patent Rights*, 40 AM. BUS. L.J. 125, 170–71 (2002); David B. Resnik & Kenneth A. De Ville, *Patents: The Public Interest Versus the Private Privilege*, AM. J. BIOETHICS, Summer 2002, at 37; Kayhan P. Parsi & Erin A. Egan, *Patents: The Public Interest Versus the Private Privilege*, AM. J. BIOETHICS, Summer 2002, at 45.

⁶⁵See Melody Petersen, *Bayer Agrees to Pay U.S. \$257 Million in Drug Fraud*, N.Y. TIMES, Apr. 17, 2003, at C1, *available online*.

D. RECENT LEGISLATION SEEKS TO PREVENT INTELLECTUAL PROPERTY LICENSING FROM OVERRUNNING THE NATIONAL DEFENSE

Even today, Congress understands that intellectual property licensing practices can interfere with American national defense strategy. Most recently, it enacted section 802 of the National Defense Authorization Act for Fiscal Year 2018 to protect the government in intellectual property licensing.⁶⁶ That section requires the Secretary of Defense to develop policy to ensure that government license negotiators “are aware of the rights afforded the Federal Government and contractors in intellectual property” and that they “fully consider and use all available techniques and best practices for acquiring or licensing intellectual property.”⁶⁷ It further creates a “cadre” of IP experts to assist military departments on “financial analysis and valuation of intellectual property” and “communications and negotiations with contractors.”⁶⁸

Legislative history confirms that section 802 is intended to protect the government during licensing negotiations. The House report observes within the Department of Defense “varying knowledge of IP matters” and finds that “the Department requires tools to improve its ability to negotiate with industry.”⁶⁹

⁶⁶National Defense Authorization Act for Fiscal Year 2018 (2018 NDAA) § 802, 10 U.S.C. § 2322.

⁶⁷2018 NDAA § 802(a)(2).

⁶⁸2018 NDAA § 802(b)(3)(C)–(D).

⁶⁹H.R. REP. NO. 115-200, pt. 1, at 165 (2017), *available online*.

The conference report similarly characterizes the IP cadre as supporting Department staff to “develop their IP strategies and negotiate with industry.”⁷⁰

Subsequent developments are of the same effect. In a press briefing, Undersecretary of Defense Ellen M. Lord explained that the purpose of the IP cadre was to avoid “problems with intellectual property when we don’t clearly define what is owned by industry, and what will be owned by government.”⁷¹ Law firms specializing in government contracts describe section 802 as “designed to ensure that DoD does not leave rights on the table when it negotiates the scope of IP rights,”⁷² and even advise contractors to “beware” that section 802 “will make the DoD a more effective purchaser of IP.”⁷³

The 2018 NDAA demonstrates an ongoing concern that IP licensing can interfere with American national defense operations, and that policy solutions are necessary to resist aggressive licensing. That Congress found it necessary to address this issue in the narrow field of procurement signals a need for all parts of

⁷⁰H.R. CONF. REP. NO. 115-404, at 863 (2018), *available online*.

⁷¹Ellen M. Lord, Press Briefing on Acquisition Reform and Innovation (Aug. 26, 2019), *available online*. Undersecretary Lord’s response is notable because she limits the IP cadre to this domestic defensive task, rejecting the idea that the cadre has an “offensive” role in dealing with Chinese IP theft or such issues. *See id.* (question of Aaron Mehta).

⁷²Mary Beth Bosco, *2018 NDAA Analysis: Intellectual Property Provisions*, HOLLAND & KNIGHT GOV’T CONT. BLOG (Dec. 12, 2017), *available online*.

⁷³Adam Bartolanzo & Keith Szeliga, *Contractors Beware: The 2018 NDAA Ushers In New Changes Affecting IP Rights*, GOV’T CONT. & INVESTIGATIONS BLOG (Jan. 30, 2018), *available online*.

government, including courts that enforce competition laws, to be aware of the consequences of intellectual property for national security.

III. THE PROCOMPETITIVE EFFECTS OF ANTITRUST ENFORCEMENT IN PATENT LICENSING ARE NECESSARY TO ENSURE TECHNOLOGICAL SUPERIORITY AGAINST CHINA

Hanging over this case is the ongoing question of America’s standing in relation to other technology superpowers, most notably China.⁷⁴ Here, again, the national security concerns attendant to American technological superiority counsel in favor of competition rather than single-firm dominance.

Multiple technologies today are the focus of competition against China. In the present case, Qualcomm and the Department of Justice have invoked the next-generation mobile communications standard, commonly known as 5G.⁷⁵ Other technological “races” include artificial intelligence and quantum computing. Innovation in each of these technological fields takes on a national security di-

⁷⁴National security also comes up in the context of “intellectual property theft” conducted by China. That issue is inapposite to this case because the “intellectual property” being stolen is trade secrets, not patents. See Scott J. Shackelford, *Protecting Intellectual Property and Privacy in the Digital Age: The Use of National Cybersecurity Strategies to Mitigate Cyber Risk*, 19 CHAP. L. REV. 445, 455–56 (2016) (criticizing national security policies for conflating trade secrets with “intellectual property protections more generally”).

⁷⁵See Qualcomm’s Mot. Partial Stay Inj. Pending Appeal 28, July 8, 2019 (Doc. No. 9); United States’ Statement Interest Concerning Qualcomm’s Mot. Partial Stay Inj. Pending Appeal 12–13, July 16, 2019 (Doc. No. 25).

mension because breakthroughs in any of these fields confer not just economic benefits but also potential military advantages.⁷⁶

The present case is crucial to these technological races because, as Secretary Chertoff explains, “[i]n the technology race against China, the U.S. should prefer to let competition drive innovation rather than support exclusive national champions.”⁷⁷ Economic research confirms this. A 2009 study found that the entry of competitors into industries “induces incumbents in sectors that are initially close to the technology frontier to innovate more.”⁷⁸ Incremental innovations enable a firm to “escape” competition temporarily, so the presence of competition draws companies to innovate in order to enjoy that escape.⁷⁹ Innovative growth in duopoly markets appears to occur in a “step-by-step” fashion in which each firm copies and then outdoes its competitor; “a little imitation is almost always growth-enhancing” by “promoting more frequent neck-and-neck rivalry.”⁸⁰

⁷⁶See Jim Baker, *5G Networks Must Be Secure and Reliable*, LAWFARE (Mar. 13, 2019), *available online*; GREG ALLEN & TANIEL CHAN, ARTIFICIAL INTELLIGENCE AND NATIONAL SECURITY 12–20 (July 2017), *available online*; Steve Grobman, *Quantum Computing Must Be a National Security Priority*, SCI. AM.: OBSERVATIONS (Oct. 25, 2018), *available online*.

⁷⁷Chertoff, *supra* note 2.

⁷⁸Philippe Aghion, Richard Blundell, Rachel Griffith, Peter Howitt & Susanne Prantl, *The Effects of Entry on Incumbent Innovation and Productivity*, 91 REV. ECON. & STAT. 20, 20 (2009).

⁷⁹See *id.* at 21–22, 27.

⁸⁰Philippe Aghion, Christopher Harris, Peter Howitt & John Vickers, *Competition, Imitation and Growth with Step-by-Step Innovation*, 68 REV. ECON. STUD. 467, 470 (2001).

To be sure, patents and even market concentration can also foster innovation, but only to a degree. Market concentration shares an “inverted-U” relationship with innovation such that excessive monopolization diminishes incentives to innovate.⁸¹ With respect to patents, a 2015 study considered the impact of competition policy and patent strength on innovation among European firms, measured in terms of research and development spending.⁸² The study compared countries with strong patent laws against countries with weaker patent laws, and “found no effect of patent protection on R&D intensity,” a conclusion consistent with multiple other studies.⁸³ However, the study found that when a major competition reform went into effect, strong-patent countries enjoyed a boost in innovation greater than that experienced in weak-patent countries in most patent-intensive industries.⁸⁴ In other words, strong patent protection is complementary to strong competition; the former does not promote innovation without the latter.

⁸¹See Philippe Aghion, Nick Bloom, Richard Blundell, Rachel Griffith & Peter Howitt, *Competition and Innovation: An Inverted-U Relationship*, 120 Q.J. ECON. 701, 702 (2005).

⁸²See Philippe Aghion, Peter Howitt & Susanne Prantl, *Patent Rights, Product Market Reforms, and Innovation*, 20 J. ECON. GROWTH 223, 230 (2015).

⁸³*Id.* at 238; see Mariko Sakakibara & Lee Branstetter, *Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reforms*, 32 RAND J. ECON. 77, 78 (2001); Yi Qian, *Do National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment? A Cross-Country Analysis of Pharmaceutical Patent Protection, 1978–2002*, 89 REV. ECON. & STAT. 436, 450 (2007).

⁸⁴Aghion, Howitt & Prantl, *supra* note 82, at 243.

In the face of this evidence that competition secures America’s technological leadership, Qualcomm and its supporters must argue that single-firm dominance is in fact better for innovation and thus national security. They try, and their arguments are as troubling as they are wrong.

Characteristic of these arguments is the Department of Defense declaration before this Court.⁸⁵ The declaration notes that the Department is dependent on Qualcomm’s many “mission-critical telecommunications products,” observes that “market realities leave Qualcomm as the clear U.S. leader” in 5G technology, and hypothesizes that “any disruption of supply of Qualcomm products or services to the U.S. Government, or of Qualcomm’s related R&D, even for a short period of time, could have a detrimental impact on national security.”⁸⁶ The Department thus concludes: “Any measure that inappropriately reduces Qualcomm’s revenue substantially . . . could harm national security”—that the security of America depends on Qualcomm’s monopoly profits.⁸⁷

Besides oddly making Qualcomm out to be a “de facto ‘national champion’” in a manner inconsonant with capitalism,⁸⁸ the Department of Defense declaration

⁸⁵See Decl. Under Secretary Defense Acquisition & Sustainment Ellen M. Lord, July 16, 2019 (Doc. No. 25-2).

⁸⁶*Id.* ¶¶ 5, 10.

⁸⁷*Id.* ¶ 16.

⁸⁸Claude Barfield, *The Justice Department’s Unprecedented Intervention in the Federal Trade Commission Case Against Qualcomm: Implications for 5G*, AM. ENTERPRISE INST. (May 10, 2019), *available online*.

ignores the teachings of history. It ignores how naval dependence on a single torpedo innovator left American warfighters in the lurch. It ignores how patent-backed control over the aviation industry forced America to lag in that global technological race. It ignores how patent assertions stymied the nation's ability to defend itself from an imminent bioterrorism threat. And it ignores Congress's direction in section 802 of the 2018 NDAA that the Department of Defense should push back on aggressive patent licensing, not succumb to it.

Qualcomm is correct that national security interests are important in this case, but the company's positions ultimately undermine those interests. American cybersecurity and technological superiority depend on free-market competition, which depends in turn on robust application of the competition laws to prevent the national-scale harms of monopolistic patent licensing.

CONCLUSION

For the foregoing reasons, the decision of the district court should be affirmed.

Respectfully submitted,

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s/Charles Duan

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Dated: November 28, 2019

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I hereby certify that I electronically filed the foregoing **Brief of the R Street Institute as *Amicus Curiae* in Support of Plaintiff-Appellee** with the Clerk of the Court for the United States Court of Appeals for the Ninth Circuit by using the appellate CM/ECF system on **November 28, 2019**.

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