



Long Comment Regarding a Proposed Exemption Under 17 U.S.C. § 1201

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ITEM A. COMMENTER INFORMATION

iFixit is an international, open-source, online repair manual for everything. iFixit represents a global community of makers, fixers, refurbishers, tinkerers, and repair professionals. In 2020, iFixit helped over 100 million people repair everything from mobile phones to cars and tractors. Expansion of these exemptions is necessary to preserving ownership rights, maintaining a consumer's right to repair, and enabling iFixit to continue helping customers repair the devices they own.

The Repair Association, Repair.org ("Repair.org") represents the combined interests of repair professionals in the technology aftermarket. Its members span the interests of individuals, non-profits, and for-profits engaged in the repair, resale, recycling, and re-commerce of technology driven equipment. Its mission is to advocate for repair-friendly policies, regulations, statutes, and standards at the federal, state, and local level.

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Privacy Act Advisory Statement: Required by the Privacy Act of 1974 (P.L. 93-579)

The authority for requesting this information is 17 U.S.C. §§ 1201(a)(1) and 705. Furnishing the requested information is voluntary. The principal use of the requested information is publication on the Copyright Office Web site and use by Copyright Office staff for purposes of the rulemaking proceeding conducted under 17 U.S.C. § 1201(a)(1). NOTE: No other advisory statement will be given in connection with this submission. Please keep this statement and refer to it if we communicate with you regarding this submission.

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ITEM B. Proposed Class Addressed

Proposed Class 12: Computer Programs – Repair

ITEM C. OVERVIEW

iFixit and Repair.org (collectively, “Commenters”) submit these comments in support of expanding the exemption for repairing devices to encompass all lawfully owned devices. In particular, Commenters propose the following language for an expanded exemption (the “Proposed Expanded Exemption”):

Computer programs that are contained in and control the functioning of a lawfully acquired device, when circumvention is a necessary step to allow the diagnosis, maintenance, modification, or repair of such a device.

The Copyright Office (the “Office”) has indicated that it intends to recommend renewal of similar exemptions for “computer programs that control smartphones, home appliances, or home systems” and “computer programs that control motorized land vehicles, including farm equipment.”¹ Although intended to be carefully crafted, these classes remain unnecessarily narrow and ambiguous in scope. The “smartphone” exemption may allow the repair of an iPhone, but not an iPad. Smart refrigerators may be repaired as “home appliances” if they are used at home, but it is unclear if whether the exemption would cover an industrial fridge in a home setting or a home fridge in an industrial setting. One possible interpretation is that commercial equipment can be repaired if it is taken home first. It is similarly ambiguous whether commercial HVAC systems used in apartment homes and condos are “home systems.” The Office should eliminate these ambiguities and stop the proliferation of unnecessary narrow categories by clarifying and expand the exemption to cover all lawfully acquired devices.

The Copyright Office Can and Should Interpret “Class of Work” Reasonably Broadly

The Librarian of Congress (the “Librarian”) can and has granted exemptions covering broad classes of devices when circumvention is achieved for a lawful purpose. For example, the current exemption for security research applies without regard to the specific type of device.² Similarly, the Copyright Office has previously interpreted the congressional record to mean that “while the category of motion pictures and other audiovisual works in section 102 may appropriately be subdivided, for purposes of the rulemaking, into classes such as motion pictures, or television programs, it would be inappropriate to subdivide overly narrowly into particular genres of motion pictures, such as Westerns, comedies, or live action dramas.”³ Regardless, the Office has

¹ Exemptions to Permit Circumvention of Access Controls on Copyrighted Works: Notice of Proposed Rulemaking, 85 Fed. Reg. 65,295, 65,299-300 (Oct. 15, 2020).

² See 37 C.F.R. § 201.40(b)(11) (exempting circumvention for good-faith security research without regard to device type).

³ Acting Register of Copyrights, *Section 1201 Rulemaking: Seventh Triennial Proceeding to Determine Exemptions to the Prohibition on Circumvention: Recommendation of the Acting Register of Copyrights* 14 (2018) (citation

in the past separated out devices for individual examination and evaluation, and forcing each new device to pass through the gauntlet of the triennial to be eligible for repair.⁴

Under the Copyright Office’s current approach, the number of possible device categories is enormous. In terms of pure numbers of devices, a simple search for electronic gadgets on Amazon yields more than 10,000 results.⁵ Everything from eye masks for sleep to radio-controlled quadcopters to the GolfBuddy Voice 2 Golf GPS/Rangefinder⁶ is a software-enabled device. But the piecemeal approach of prior exemptions results in differences in what is lawful that are unrelated both to copyright interests and to any differences in the devices themselves, leaving owners of essentially similar devices in unspecified categories in the dark.

The existing exemptions illustrate this problem: The same manufacturers may build both marine and tractor engines,⁷ but circumvention of that manufacturer’s ECU TPM is allowed for the latter and illegal for the former.⁸ A smartphone and a tablet may contain nearly identical firmware,⁹ and similar hardware,¹⁰ and typically require the same the repairperson’s skills,¹¹ but the smartphone TPM may be bypassed under the current exemption and the tablet TPM may not be.¹² Although CPAP machines are medical devices commonly used in the home and are therefore arguably “home appliances,”¹³ repairing these machines at a hospital could be illegal.¹⁴

omitted); Register of Copyrights, *Section 1201 Rulemaking: Sixth Triennial Proceeding to Determine Exemptions to the Prohibition on Circumvention: Recommendation of the Register of Copyrights* 15 (2015) (citation omitted). Hereinafter, references to the Register’s Recommendations in prior rulemakings are cited by the year of publication followed by “Recommendation” (e.g., “2018 Recommendation”).

⁴ Citing a lack of evidence on whether devices generally are similarly situated, the Acting Register in 2018 declined to recommend an exemption allowing the repair of software enabled devices generally. 2018 Recommendation 191-92.

⁵ Amazon Search Results for Gadgets in the Electronics Category, https://www.amazon.com/s?k=gadgets&i=electronics&ref=nb_sb_noss_2 [<https://perma.cc/MSS5-GLH3>].

⁶ *Id.*

⁷ See CAT Marine Engines Page, https://www.cat.com/en_US/by-industry/marine.html (last visited Dec. 14, 2020); John Deere Marine Engines Page <https://www.deere.com/en/engines-and-drivetrain/marine-diesel-engines> (last visited Dec. 14, 2020); Kohler Engines page <https://kohlerpower.com/en/engines> (last visited Dec. 14, 2020) (advertising both marine and land-vehicle engines).

⁸ 37 C.F.R. § 201.40(b)(9) (“Computer programs that are contained in and control the functioning of a lawfully acquired motorized *land* vehicle . . .”) (emphasis added).

⁹ The Android Operating System powers both tablets and smartphones. Android Phones and Tablets Page, <https://www.android.com/phones-tablets/> [<https://perma.cc/TZ39-6Q2Z>] (last visited Dec. 14, 2020). iPadOS that powers Apple tablets is built on the same foundation as iOS that powers iPhones. Apple iPadOS Home Page, <https://www.apple.com/ipados/ipados-14/> [<https://perma.cc/G5G3-NPUY>] (last visited Dec. 14, 2020).

¹⁰ See <https://www.lifewire.com/features-ipad-vs-iphone-ipod-touch-1999857>.

¹¹ See e.g., Repair Zoom Home Page, <https://www.repairzoom.com> (last visited Dec. 14, 2020) (advertising repair for both iPad, iPhone and Samsung Galaxy repair); iPad Rehab YouTube Channel, https://www.youtube.com/channel/UCPjp41qeXe1o_lp1US9TpWA (last visited Dec. 14, 2020) (featuring both iPad and iPhone repair).

¹² 37 C.F.R. § 201.40(b)(10) (exempting smartphones and home appliances specifically).

¹³ See Michigan Medicine, *Continuous Positive Airway Pressure (CPAP) Therapy for Obstructive Sleep Apnea*, <https://www.uofmhealth.org/health-library/hw48752#:~:text=You%20use%20CPAP%20at%20home,of%20mask%20is%20most%20common>.

¹⁴ Whether “home appliances” refers to appliances in the home or appliances meant to be used in the home is not specified in the regulation. 37 C.F.R. § 201.40(b)(10).

Likewise, a home refrigerator certainly may be repaired under the current exemption, yet repairing that same refrigerator in a commercial setting is potentially unlawful.¹⁵

Basing the repair exemption on a narrow subset of software-enabled devices does more than cause the idiosyncrasies described above—it adversely impacts owners who need to repair and maintain their devices. Even where the Copyright Office determines that the owner of one device was deserving of an exemption, the owner of an analogous device with the same firmware and hardware must wait three years and request a “new” exemption before lawfully making their own repair. And, the complexity of this exemption process may require hundreds of hours of attorney time and take almost a year to reach resolution, making it infeasible for ordinary consumers and repair technicians.¹⁶ This was the situation that tablet owners and boat owners are in after 2018. This result is hardly consistent with the call of the statute for the Office to determine “whether persons who are users of a copyrighted work are, or are likely to be in the succeeding 3-year period, adversely affected by the prohibition under [17 U.S.C. § 1201(a)] in their ability to make noninfringing uses under this title of a particular class of copyrighted works” because, in large part, the office has already determined that they are. The statute does not demand that a user of a software-enabled toothbrush or lightbulb must request an exemption to fix that one device—it merely requires that the user be adversely affected. In preventing lawful repair of all software-enabled devices, Section 1201’s anticircumvention prohibitions adversely impact all owners of those devices, regardless of which *specific* software enabled device they own. These comments, and others like it, meet that burden for all users of all software-enabled devices encumbered by TPMs.

The Copyright Office has some flexibility to determine the scope of a “class” of works, as it has done in every Triennial. based on the evidence presented.¹⁷ “[D]eciding the scope or boundaries of a particular class of copyrighted works... is an important issue to be determined based upon the law and facts developed *in the proceeding*.”¹⁸ As we demonstrate below, the proper scope for an exemption in this case is the Proposed Expanded Exemption for repair of all software enabled devices. In particular, we show that all software-enabled devices share all significant features with respect to repair, that the TPM schemes protecting devices from repair are largely the same, that the repair of devices is a noninfringing activity, that the software in devices is likely also to be owned, that the repair of devices generally is impaired by the prohibition on exemption, and that other factors properly considered by the office support this exemption. In other words, in all ways relevant to this proceeding, the computer programs in software-enabled devices should be treated as a single class of works when access is for the purpose of repair.

ITEM D. TECHNOLOGICAL PROTECTION MEASURE(S) AND METHOD(S) OF CIRCUMVENTION

The Office has previously recognized and continues to recognize that TPMs effectively control access to the computer programs in software-enabled devices within the meaning of the statute.

¹⁵ *Id.*

¹⁶ See Andrew F. Sellers, *Comment of the Cyberlaw Clinic at Harvard Law School* 1 (2016) <https://www.regulations.gov/document?D=COLC-2015-0012-0052> (“[I]n the most recent rulemaking, the attorneys, students, and interns at the Cyberlaw Clinic logged approximately 575 hours of work to obtain the exemption . . .”).

¹⁷ See e.g., 2000 Recommendation 65 Fed. Reg. 64,559 (Oct. 27, 2000); 2003 Recommendation 11, 2006 Recommendation 9.

¹⁸ 2018 Recommendation 14 (emphasis added) (citation omitted).

Indeed, the Office intends to renew already granted exemptions for the repair of software-enabled devices in categories including motorized land vehicles, smartphones, home appliances, and home systems.¹⁹ The same TPMs are at issue here, bypassed in the same way, to perform the same noninfringing use: repair.

The Office has Previously Addressed the Types of TPMs Preventing Repair of Software-Enabled Devices

Earlier petitions for the motorized land vehicles and smartphones, homes appliances, and home systems repair exemptions detailed the types of TPMs that are also implemented across a wide variety of software-enabled devices, and we revisit them below:

Passwords Required to Perform Maintenance and Repair

Many devices require service passwords before a user can access the device settings that could return a device to normal operation or display diagnostic information to tell owners or repair technicians what’s wrong with the device.

Wheelchairs powered by Dynamic DX control systems require passwords and hardware security dongles to access critical configuration parameters. The user manual states, “WARNING! A Quantum Rehab Provider or a qualified technician must perform the initial setup of this power chair and must perform all of the procedures in this manual.”²⁰ A user may need to change the speed damping setting to offset a failing wheel or motor, or to accommodate an aftermarket part. Or they might use a different tire for navigating inclement weather and need to adjust the wheel grip software parameters. Unfortunately, users cannot make these changes without bypassing the security dongle. “The Wizard requires a hardware security key (dongle) to write parameters to a controller. Without dongle the Wizard can still display parameter values and diagnostic messages, but nothing can be edited or written to a controller.”

¹⁹ Exemptions to Permit Circumvention of Access Controls on Copyrighted Works: Notice of Proposed Rulemaking, 85 Fed. Reg. 65,295, 65,299-300 (Oct. 15, 2020).

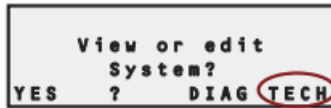
²⁰ *DX Modular Power Chair Control System: DX System Manual* 114 <https://www.dynamiccontrols.com/sites/default/files/2018-05/dx-system-manual-issue1.pdf> [<https://perma.cc/74U3-KQ9V>]. This system is installed on powered wheelchairs. See Dynamic DX/DX2 Product Page, <https://www.dynamiccontrols.com/our-products/dx2> [<https://perma.cc/945P-JQFR>].

Some parameters are protected, they can only be accessed in Technician Mode.

To enter technician mode on the HHP:

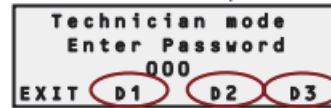
1. Turn the DX System ON
2. Connect the HHP to the DX Master Remote

3. Press TECH



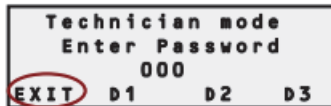
View or edit
System?
YES ? DIAG **TECH**

4. Enter the technician password



Technician mode
Enter Password
000
EXIT **D1** **D2** **D3**

5. Press EXIT



Technician mode
Enter Password
000
EXIT D1 D2 D3

6. You are now in Technician mode.



Technician mode
Master JS Module
JOYSTICK CALIBRATION
EXIT YES NEXT

Excerpt from a Dynamic DX wheelchair manual showing the entering of a “technician password.”²¹

In 2018, commenters and the Copyright Office acknowledged that passwords that prevent access to diagnostics in motorized land vehicles constitute a TPM.²² Then, as now, “passwords on diagnostic interfaces” prevented the owners from undertaking repairs.²³

This same type of TPM is generally used on a wide variety of software-enabled devices. Manufacturer-set passwords preventing access to device software for repair purposes have been reported on hospital ventilators,²⁴ wheelchairs,²⁵ medical imaging devices,²⁶ microscopes²⁷ and enterprise phone systems, to name only a few.²⁸ The circumvention methods for these password

²¹ *Id.*

²² *See, e.g.*, 2018 Recommendation 187.

²³ *See id.*

²⁴ *See* Ebme Forums, *Maquet Servo I Change Password* (Sept. 15, 2015).

https://www.ebme.co.uk/forums/ubbthreads.php/topics/69767/Maquet_Servo_I_change_Password (reporting that contact with the manufacturer is needed to change the password); *see also*, Maquet, *Servo-I Ventilator System Service Manual 5*, <https://www.ifixit.com/Document/jpuqR1CDDumFeves/Maquet-Servo-i-Service-Manual.pdf> (“Only personnel trained and authorized by Maquet shall be permitted to perform installation, service or maintenance of the Servo-i.”).

²⁵ *See supra* note 21. Wheelchairs may be exempted as motorized land-vehicles, but this is unclear. *See* 37 C.F.R. § 201.40(b)(9).

²⁶ Entire websites exist to enable the sale of service passwords for CT Scanners, MRI Scanners, and others. *See e.g.*, Service Password for CT Scanner Home Page, <http://www.service-password.com>.

²⁷ iFixit has received at least one email from a device user reporting that the diagnosis of microscopes is only possible with a password.

²⁸ The TPM in these systems have been subject to extensive litigation involving phone system manufacturer Avaya. *Avaya Inc., RP v. Telecom Labs, Inc.*, 838 F.3d 354, 367 (3d Cir. 2016) (“Users of the maintenance features — whether Avaya technicians, non-Avaya technicians, or customers themselves — access the pertinent software using login credentials.”); *id.* at 365.

systems are also essentially the same: brute-force-guessing,²⁹ buying passwords,³⁰ or exploiting software vulnerabilities, as in the vehicle context.³¹

Requiring Replacement Parts be Specific to the Device or Manufacturer

Hard coding of interlinked parts is an increasingly common form of TPM used in software-enabled devices. This means that, in many newer devices, the software is written so that parts are no longer replaceable without accessing the underlying software. This was also documented in the motorized land vehicle context.³² The same form of TPM is used in smartphones – for example to link an iPhone’s home button to its logic board, impeding replacement. The Copyright Office recommended an exemption for smartphone unlocking where this is the case.³³

But, there are additional ways manufacturers use TPMs to control which replacement parts may be used. Hospital ventilators,³⁴ vacuum cleaners,³⁵ litterboxes,³⁶ cameras,³⁷ laptops,³⁸ and garage door openers³⁹ may all contain TPMs that prevent replacement with parts from third party vendors. In the case of the Puritan Bennett 840 ventilator, this TPM can be bypassed with a small computer dongle that restores interoperability with the aftermarket monitor. “It’s a little box that

²⁹ See Kit Walsh, Corynne McSherry, Mitchell Stolz, *Comment of Electronic Frontier Foundation* 4 (2014) (“Solving the challenge-response mechanism by brute force analysis is mathematically possible (requiring a little over a week for a 16-bit key)”) (citation omitted) https://cdn.loc.gov/copyright/1201/2015/comments-020615/InitialComments_longform_EFF_Class21.pdf. Passwords and the like were described during the 2015 Triennial as “challenge-response mechanisms.” *Id.* at 3.

³⁰ See Service Password for CT Scanner *supra* n. 25

³¹ See Walsh, *supra* n. 29 at 5 (“By connecting a voltmeter to data pins on the physical hardware, it is sometimes possible to extract information from memory”).

³² See e.g. Vice Youtube Channel, *Farmers Are Hacking Their Tractors Because of a Repair Ban*, https://youtu.be/EPYy_g8Nzml?t=232 (displaying a receiver part from a tractor that cannot be replaced with a seemingly identical one).

³³ See 2018 Recommendation 210 (“For example, Mr. Wiens testified that it is necessary to circumvent a TPM to replace an iPhone home button.”).

³⁴ See Jason Koebler, *Why Repair Techs Are Hacking Ventilators with DIY Dongles from Poland*, MotherBoard (July 9, 2020), <https://www.vice.com/en/article/3azv9b/why-repair-techs-are-hacking-ventilators-with-diy-dongles-from-poland> (“like so many other electronics, medical equipment, including ventilators, increasingly has software that prevents ‘unauthorized’ people from repairing or refurbishing broken devices, and [the manufacturer] will not help him fix them.”); see also, e.g., *Servo-i Ventilator System Service Manual*, Maquet *supra* n. 24 at 5, <https://www.ifixit.com/Document/jpuqR1CDDumFeves/Maquet-Servo-i-Service-Manual.pdf> (“Only Maquet genuine spare parts must be used”).

³⁵ Batteries for Roomba robot vacuums have been reported as not interchangeable. See Robot Reviews, *iRobot Roomba and Scooba Chat* (Sept. 3 2020) <http://www.robotreviews.com/chat/viewtopic.php?f=1&t=22674> (“Unfortunately, iRobot’s battery DRM prevents the robot from fully booting and charging. It simply states ‘Please insert an iRobot battery.’”).

³⁶ See Brian Benchoff, *Cracking Litter Box DRM*, (Jan. 19, 2015), <https://hackaday.com/2015/01/19/cracking-litter-box-drm/>.

³⁷ See David Coleman, *Updated Third-Party Batteries for the GoPro HERO5 Black*, (Last Updated Nov. 6 2020) <https://havecamerawilltravel.com/gopro/wasabi-power-batteries-gopro-hero5-black>.

³⁸ Although not yet activated, software locks have been reported on Macbooks. See Adam O’Camb, *Apple’s Secret Repair Kill Switch Hasn’t Been Activated—Yet*, (Oct. 5, 2018), <https://www.ifixit.com/News/11673/t2-mac-repairs-test>.

³⁹ See Nate Anderson, *What Is DRM Doing in my Garage?* (Dec. 16 2009), <https://arstechnica.com/tech-policy/2009/12/what-is-drm-doing-in-my-garage>. Garage doors are possibly “home appliances” or “home systems” exempt under 37 C.F.R. § 201.40(b)(10).

goes in between the monitor and the breath delivery unit,” William, a ventilator refurbisher told Vice. William used this circumvention to restore 70 ventilators during the pandemic.



A “Dongle” Used by a Hospital in Repairing a Ventilator⁴⁰

Separate Calibration Software that Must Be Connected to Receive Diagnostic Information

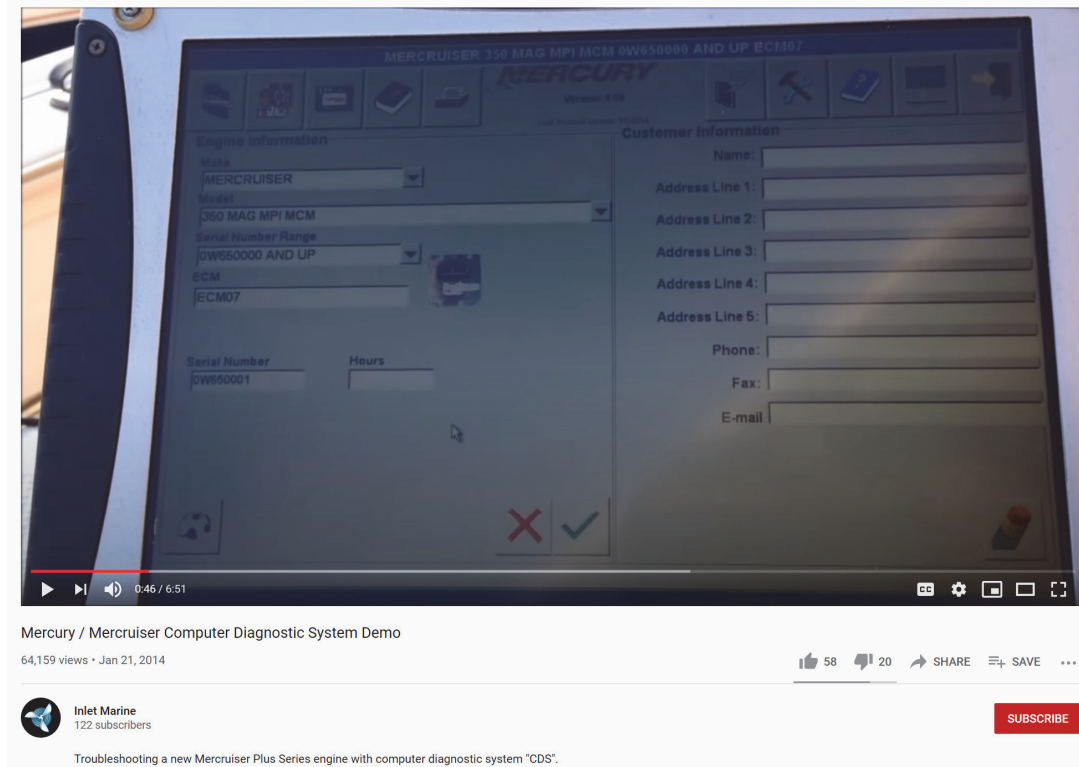
Common in tractors and other land vehicles,⁴¹ this form of TPM is also present in devices that are not covered by the current land vehicle exemption. Notably, this form of TPM was used in boats during the 2018 triennial review cycle⁴² yet the narrowly drafted exemption excludes non-land vehicles. But boat and tractor owners are similarly adversely impacted by Section 1201’s prohibition on circumvention—dealers of both vehicles are often located far from where the vehicles are used and the manufacturers will not sell their diagnostic software to the owners themselves.⁴³ There is no difference between boats and land vehicles when it comes to copyright interests and the non-infringing purpose of repair.

⁴⁰See Walsh *supra* n. 29 at 5.

⁴¹ See e.g., Jason Koebler, *Why American Farmers Are Hacking Their Tractors With Ukrainian Firmware* <https://www.vice.com/en/article/xykkkd/why-american-farmers-are-hacking-their-tractors-with-ukrainian-firmware> (“John Deere Service Advisor: A diagnostic program used by John Deere technicians that recalibrate tractors and can diagnose broken parts. “It can program payloads into different controllers. It can calibrate injectors, turbo, engine hours and all kinds of fun stuff,” someone familiar with the software told me.”)

⁴² See RiverdalePlace Forum, *What is the Software a Mercruiser Tech would Use to Diagnose Problems/Change Parameters* (Apr. 7, 2018), <https://www.riverdavesplace.com/forums/threads/what-is-the-software-a-mercruiser-tech-would-use-to-diagnose-problems-change-parameters.182089/> (users describing how dealer software may be required for some settings); see also Mercury, *CDS G3 Users Manual: Version 1.7 Software* (2016), <https://service.mercurymarine.com/media/1010/cdsg3usermanual17.pdf>; Mercury CDS G3 Home Page, <https://service.mercurymarine.com/g3/home/> (“CDS G3 is delivered via a download. A license key is required to unlock the software and only contracted Mercury Marine dealers are authorized to use the software.”);

⁴³ See RiverdalePlace Forum *supra* n. 42 (“Since it’s a long way from where I keep the boat to a dealer, I’d like to get the diagnostic tools for my own use.”)



*Factory-Authorized Servicer Showcasing Mercury Diagnostic Software
Used for Boat Engines⁴⁴*

That tractor repair is permitted but boat repair is not is a distinction without a difference. This is especially clear when the same diagnostic software is used in both marine and land vehicle engines, which is very likely the case for the owner of a marine engine manufactured by John Deere, Caterpillar, or Kohler Power. All three manufacturers make engines (and diagnostic software) for both land and water-borne vehicles.⁴⁵

Customers and technicians are not able to perform diagnostics or reset fault codes without this software. The customer version of ServiceADVISOR is costly and restrictive. “I work at a Deere dealership... If you get the program you can troubleshoot codes and link with your equipment. That is about all you can do. You unfortunately cannot do any programming or say if you replace a sensor that went bad, you cannot adjust anything in any way on your machine.”⁴⁶ Frequently, the electronic engine installed in ships does not have a diagnostic gauge or display mounted in the control panel. This real-time engine diagnostic information is essential for engine operators.

⁴⁴ Inlet Marine, *Mercury/Mercuriser Computer Diagnostic System Demo*, YouTube (Jan. 21, 2014), <https://www.youtube.com/watch?v=IZNwERh-AV8>.

⁴⁵ See *supra* note 7.

⁴⁶ *J.D. Service Advisor*, The Combine Forum (Feb. 26, 2016) <https://www.thecombineforum.com/threads/jd-service-advisor.253730/> [<https://perma.cc/SQ78-LS5X>] (“I work at a Deere dealership and we were talking about this today. If you get the program you can troubleshoot codes and link with your equipment. That is about all you can do. You unfortunately cannot do any programming or say if you replace a sensor that went bad, you cannot adjust anything in any way on your machine. Even though your machine belongs to you, the computer technology belongs to Deere. In my opinion, it is a waste of your money”).

Kohler Power describes these restrictions in their marine generator owner’s manual: “Have setup and adjustments of the Decision-Makerr 3500 controller performed only by an authorized Kohler distributor/dealer. The setup and adjustments are password protected.”⁴⁷

This form of TPM is by no means limited to vehicles. External settings software is used to correct problems with hearing aids,⁴⁸ and specialized computers with embedded software (dongles) are often used to control the settings on power wheelchairs.⁴⁹

Manufacturers are Constantly Adding TPMs to an Ever-Growing List of Devices

Software is increasingly embedded in every imaginable type of product, and manufacturers are increasingly deploying TPMs to prevent access to that software. This often has the undesirable effect—intended or unintended—of hindering diagnosis, maintenance, and repair, traditional uses of those products. As this Office has explained, “[a]s copyrighted software is embedded into a greater diversity of products, careful thought must be given to how copyright affects consumers’ ability to engage in traditional uses of those products.”⁵⁰ Thus, this Office must carefully consider how the use of TPMs in the broadly defined category of software-enabled devices is affecting whether consumers can fix all of their new software-enabled devices, just as they could fix all of their old ones. Absent a broadly crafted exemption for repair of software-enabled devices, consumers and repair technicians alike will face legal uncertainty and the risk of harsh penalties, even where no copyright violation would otherwise exist and there is no other legal impediment to repair.

Even where the lawful repair of devices is undisputedly noninfringing, a lack of a clear and explicit exemption still creates liability risk. TPMs are particularly harmful when they prevent repair of large, expensive devices designed for long-term use. This is partially reflected in prior exemptions focused on large and expensive items such as cars, refrigerators, and home heating and cooling systems. But software-enabled devices outside these categories may be of similar high cost, and there is no principled distinction between a \$5,000 laptop and a \$5,000 HVAC system in terms repair. By implementing TPMs into these high-cost devices, manufacturers effectively rob consumers of the full benefits of ownership over these devices by dictating how they can be repaired, modified, and used. This pernicious business model not only disempowers the very people the devices were designed to serve, it fuels a culture of planned obsolescence by encouraging manufacturers to waste natural resources by designing products with short expected life spans.

⁴⁷ OPERATION MANUAL, MARINE GENERATOR SETS MODELS 14/16/21/24/32/40EKOZD, 12/13.5/17/18/20.5/28/35EFKOZD 1, 19, <http://www.kohlerpower.com/onlinecatalog/pdf/tp7044.pdf> [<https://perma.cc/FER7-UWBD>] (last accessed Dec. 12, 2020) [hereinafter Kohler Operation Manual].

⁴⁸ See *Oticon Remote Care Quick Guide 1*, <https://wdh02.azureedge.net/-/media/oticon-us/main/download-center/remotecare/15555-10525---remotecare---quick-guide.pdf?la=en&rev=6261&hash=F46181B3EA665CC350997299EA432606> [<https://perma.cc/X8CV-8W44>] (last accessed Dec. 14, 2020) (stating that the manufacturer’s remote care program enables medical professionals to use external manufacturer software to “make real-time adjustments to your patient’s hearing instruments remotely,” suggesting that patients, as owners of these devices, cannot make these adjustments themselves).

⁴⁹ See *supra* note 21 and accompanying text.

⁵⁰ U.S. Copyright Office, *Software Enabled Consumer Products*, 8 (Dec. 2016) [hereinafter 2016 Software Study], <https://www.copyright.gov/policy/software/software-full-report.pdf>.

Alternatives to Circumvention Are Inadequate

Like the TPMs listed above, the Copyright Office has seen the alternatives to circumvention before, and for the granted device repair exemptions, found them insufficient. Farmers live and work too far from dealerships to take large vehicles in for repair.⁵¹ Device manufacturers, who were under no obligation to continue updating software or repairing devices after a warranty expired, have simply stopped updating software or repairing devices.⁵² Or, the device manufacturers may simply go out of business. In some cases replacements may be bought or installed, but at exorbitant costs of money and time.

The same considerations apply to all software-enabled devices. People in rural areas own not just farm equipment and cars, but hearing aids, boats, vacuums and a wide assortment of other devices, all of which will stop working at some point. Large hospitals in rural areas with software-enabled medical devices need access to speedy repairs when a manufacturer is not nearby. Time is always of the essence when your business is saving lives.

ITEM E. ASSERTED ADVERSE EFFECTS ON NONINFRINGEMENT USES

As noted above, the Copyright office has already recognized that the repair of software-enabled devices is a non-infringing use that can qualify for an exemption, and has indicated that it intends to recommend renewal of similar exemptions for “computer programs that control smartphones, home appliances, or home systems” and “computer programs that control motorized land vehicles, including farm equipment.”⁵³ Rather than continuing piecemeal by adding arbitrarily narrowly defined exemptions, the Copyright Office should recognize that “computer programs that control the functioning of a lawfully acquired device for the purposes of repair of that device” *is* the proper scope for the exemption.

The Repair of Software-Enabled Devices is a Non-Infringing Use

The Copyright Office has already recognized that repair of software-enabled devices is likely to be a non-infringing use, and there is no reason to reevaluate the law as it relates to each specific software-enabled device. The Office has addressed this question both specifically,⁵⁴ and more generally in its 2016 report on software-enabled consumer devices.⁵⁵ There, the Office found that “current copyright law, properly interpreted, may provide relief for many repair and tinkering activities. Traditional copyright doctrines such as the idea/expression dichotomy, merger, *scènes à faire*, and fair use provide a combined and reasonable defense for many tinkering and repair

⁵¹ See Dan D. Nabel, *Comment of the USC Intellectual Property & Technology Law Clinic* 12 (2015), https://cdn.loc.gov/copyright/1201/2015/comments-020615/InitialComments_longform_USC_Class21.pdf

⁵² Google updated their calendar API, and Samsung failed to update older smart refrigerators, essentially breaking this feature. Hundreds of users complain about this in the Google forums. See Google Forums *Can't sign in to Google calendar on my Samsung refrigerator* (Nov. 11, 2014), <https://support.google.com/calendar/forum/AAAAd3GaXpEUhfpcwO0X0c/?hl=en&gpf=%23!topic%2Fcalendar%2FUhfpcwO0X0c>.

⁵³ See *supra* note 1 and accompanying text.

⁵⁴ See e.g., 2018 Recommendation 209 (“The Acting Register concludes that the uses, on balance, are likely to be noninfringing.”).

⁵⁵ 2016 Software Study 33.

activities.”⁵⁶ Moreover, “if repair activities are authorized as a matter of fair use, or under section 117, it seems likely that users can engage in them without fear of copyright infringement.”⁵⁷

The key point is that, from a noninfringement perspective, *newly presented devices are no different than those covered by existing exemptions*; the only change is the increasing prevalence of TPM-encumbered devices. If the Copyright Office is not to be bogged down assessing every individual software-enabled toothbrush, industrial device, or cat litter box, ad infinitum, it must craft an exemption that is broad enough to cover the need for repair of all these rapidly emerging devices. Hence, the device categories should be eliminated, and a single exemption should cover all repairs.

The Repair of Software-Enabled Devices is a Noninfringing Fair Use

As the Copyright Office previously noted, repair activities are likely fair uses and therefore non-infringing.⁵⁸ It has further explained that “the fundamental purpose of any repair is to preserve or restore the functionality of a software-enabled device so that it may continue to be used,” it follows that repair constitutes a noninfringing, fair use of a copyrighted work under § 107.⁵⁹ It is hard to imagine a situation where this is not true, yet repair has not yet been universally exempted.

Indeed, fair use has often covered uses that touch on copyrighted works but that don’t directly implicate copyright interests, like search engines. Changing a battery in a vacuum should be no different. Precluding consumers, and their repairpersons of choice, from fixing an ever-expanding category of smart devices in fact may negatively impact the value of these works when, as this Copyright Office noted, “repair supports—rather than displaces—the purpose of the embedded programs that control the device.”⁶⁰

The Repair of Software-Enabled Devices is Noninfringing Under Section 117

Even if no fair use defense applied, under 17 U.S.C. § 117, an owner of a copy of software may make or authorize the making of a copy or adaptation of that computer program if that new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine.⁶¹

As for the essential step requirement, the Copyright Office has repeatedly found that “if the embedded software copy is owned, section 117(a) provides broad protections for a range of activities.”⁶² The Acting Register in 2018 specifically concluded that uses directed at copying or

⁵⁶ *Id.*

⁵⁷ *Id.*

⁵⁸ United States U.S. Copyright Office, *Section 1201 of Title 17: A Report of the U.S. Register of Copyrights* 90 (June 2017) [hereinafter 2017 Copyright Office Report]. <https://www.copyright.gov/policy/1201/section-1201-full-report.pdf> [<https://perma.cc/G9JA-BMZ5>].

⁵⁹ *Id.*

⁶⁰ *Software-Enabled Consumer Products*, *supra* note 55 at 40.

⁶¹ 17 U.S.C. § 117.

⁶² See 2018 Recommendation 210 (citing U.S. Copyright Office, *Software Enabled Consumer Products* (2016)); 2018 Recommendation 210 n. 1308 (“[S]ection 117(a) has been interpreted to permit a broad range of activities, including fixing bugs, transferring programs to a new operating system, and adding new features to make the software more useful to its owner”) (citation omitted).

adapting the computer program to enable the continued operation of a machine, including functional repair and improvements, “likely qualify as noninfringing under section 117(a)(1).”⁶³

As for whether a device is owned, the Copyright Office has noted that ownership can be complex.⁶⁴ Still, the Office has also observed that *Vernor v. Autodesk, Inc.*⁶⁵ and *Krause v. Titleserv, Inc.*⁶⁶ may provide some useful guidance.⁶⁷ The legal tests of both cases look to factors of ownership beyond the presence of a license agreement. The test under *Krause* explicitly considers whether the software is contained on a device owned by the purchaser or whether the purchaser had the right to possess and use the program forever, or whether the purchaser was free to discard or destroy the copy at any time.⁶⁸ *Vernor* requires that a licensor impose “notable use restrictions” and “significantly restrict the user’s ability to transfer the software.”⁶⁹

There is a general lack of evidence that manufacturers intend to restrict the resale of software-enabled devices in any significant way. Rather, lawsuits around the licensing of software focus on the dissemination of software outside of a device,⁷⁰ or simply on restricting repair, locking a consumer into the manufacturer’s services and products.⁷¹ This is despite the fact that “virtually all agree that section 1201 was not intended to facilitate manufacturers’ use of TPMs to facilitate product tying or to achieve a lock-in effect under which consumers are effectively limited to repair services offered by the manufacturer.”⁷²

Further, 17 U.S.C. § 117(c) explicitly states that maintenance or repair will be noninfringing when it does not require that any copies of the software be made other than those that normally occur when turning on the device.⁷³ This is the case for many software-enabled devices where circumvention is needed for repair. For example, the entering of a password usually will not create additional copies of any underlying software beyond what is required to turn the device on. Similarly, no copy of a copyrighted work is made and no derivatives are created when reading device values or changing settings in software.

The Repair of Software-Enabled Devices is a Noninfringing Use of Unprotectable Elements

In the words of this Office, “[e]ven if a user borrows portions of code from an embedded program to effectuate a repair, for use in a replacement part, or to tinker with the product’s

⁶³ 2018 Acting Register’s Recommendation 211

⁶⁴ 2018 Acting Register’s Recommendation 209.

⁶⁵ *Vernor v. Autodesk, Inc.*, 621 F.3d 1102 (9th Cir. 2010).

⁶⁶ *Krause v. Titleserv, Inc.*, 402 F.3d 119 (2d Cir. 2005).

⁶⁷ 2016 Software Study 22.

⁶⁸ See *Kraus* 402 F.3d at 124.

⁶⁹ *Vernor* 621 F.3d at 1111 (“We hold today that a software user is a licensee rather than an owner of a copy where the copyright owner (1) specifies that the user is granted a license; (2) significantly restricts the user’s ability to transfer the software; and (3) imposes notable use restrictions.”)

⁷⁰ See e.g., *Vernor*, 621 F.3d at 1105-06 (describing how the dispute stems from a copy of software sold on eBay).

⁷¹ See e.g., *Avaya Inc., RP v. Telecom Labs, Inc.*, *supra* note 29.

⁷² 2017 Copyright Office Report 92.

⁷³ 17 U.S.C. § 117(c) (“Notwithstanding the provisions of section 106, it is not an infringement for the owner or lessee of a machine to make or authorize the making of a copy of a computer program if such copy is made solely by virtue of the activation of a machine that lawfully contains an authorized copy of the computer program, for purposes only of maintenance or repair of that machine...”).

existing capabilities, there are circumstances where those portions would not be eligible for copyright protection.”⁷⁴

Facts are not copyrightable. Consequently, the factual diagnostic information gained by bypassing a requirement for specific repair software is not copyrightable. Likewise, locking codes and service passwords are not copyrightable. Accessing or copying them therefore does not constitute copyright infringement. Moreover, one is “free to use any of the ideas, methods, or other insights that make a program work—so long as they do not copy the specific lines of code from the existing program.”⁷⁵

Device repair often involves making parts compatible through the adjustment of device settings. These repairs implicate the *scènes à faire* and merger doctrines, whereby when the expressive elements of the embedded program may be influenced by external factors, such as the mechanical specifications for the device or part, or relevant industry standards, the scope of the copyright is limited.⁷⁶ Moreover, the function of software is not copyrightable due to the idea/expression dichotomy. Together, these doctrines mean that when software is accessed for repair, the scope of the copyright is more limited and copying the unprotected and thinly protected elements is not infringement.

The Lack of an Exemption Adversely Affects the Lawful Use of Personal Property

The Copyright Office has already acknowledged the adverse effects of 17 U.S.C. § 1201 on lawful repair activities. It has therefore recommended exemptions permitting the repair of tractors, cars, and smartphones. Farmers, for example, were prevented from repairing lawfully acquired tractors, and the traditional repair of cars was impeded by the combination of new software controllers and the DMCA’s restrictions. Those harms apply equally to all software-enabled devices, whether they are covered by the existing exemptions or excluded, either by accident or design.

There are a wide variety of products—from smartphones to ventilators—where manufacturers have made it increasingly difficult to repair devices by using TPMs.⁷⁷ These restrictions, which restrict consumers’ access to information about the devices they lawfully own, can carry severe consequences across industries.

In 2019, the average household contained eleven software-enabled devices,⁷⁸ and likely used many of them on a daily basis.⁷⁹ In 2020, one in ten households⁸⁰ is a smart home, utilizing

⁷⁴ 2016 Software Study 34.

⁷⁵ 2016 Software Study 14.

⁷⁶ 2016 Software Study 34.

⁷⁷ See Kevin Purdy, *Is This the End of the Repairable iPhone?*, iFixIt (Oct. 29, 2020)

<https://www.ifixit.com/News/45921/is-this-the-end-of-the-repairable-iphone> [<https://perma.cc/G27V-CCT>].

⁷⁸ Todd Spangler, *US Households Have an Average of 11 Connected Devices — And 5G Should Push That Even Higher*, Variety (Dec. 10, 2019) <https://variety.com/2019/digital/news/u-s-households-have-an-average-of-11-connected-devices-and-5g-should-push-that-even-higher-1203431225/> [perma.cc/7E54-2RTG] (“Today, U.S. households own an average of 11 connected devices, including seven with screens to view content.”).

⁷⁹ Lacey Williams-McGhee, *Top 10 IoT Common Uses for Everyday People*, Seven Tablets, <https://7t.co/blog/iot-common-uses/> [<https://7t.co/blog/iot-common-uses/>] (last accessed Dec. 13, 2020).

⁸⁰ Statista, *Smart Home Report*, Statista 1 (2020) <https://www.statista.com/outlook/279/100/smart-home/worldwide> [<https://perma.cc/TFF2-BKB2>] (“Household penetration [for digitally connected and controlled devices within a house that can be remote controlled] will be 10.6% in 2020 and is expected to hit 21.4% by 2025”).

internet-connected software-enabled home appliances, home systems, and other devices. Every device in someone's home, from their alarm clock,⁸¹ their automatic coffee maker,⁸² their refrigerator,⁸³ their washing machine,⁸⁴ the lightbulbs in their house,⁸⁵ their car,⁸⁶ their garage door opener,⁸⁷ their thermostat,⁸⁸ their cat's litter box,⁸⁹ and even their toothbrush,⁹⁰ may be a software-enabled device, which in turn may be encumbered by a TPM.

Repairs are inevitable when devices are used on a regular basis. And yet, under the current exemptions, owners may only lawfully repair a few of these products themselves. The rest remain in purgatory until a team of lawyers can dedicate the hundreds of hours needed⁹¹ to petition the Copyright Office for an exemption for those specific devices. Meanwhile, shipments of smart home devices are increasing annually at a rate of up to 31%.⁹² The worldwide number of internet-of-things devices—all of which are by definition software-enabled—is projected to increase to 43 billion by 2023, an almost threefold increase from 2018.⁹³ At this rate of growth, the number of exemption petitions facing the Copyright Office in the next triennial hearing could increase exponentially if the Office sticks to its piecemeal approach.

As we saw this past year, the delay caused by this Office's approach isn't just inconvenient for consumers—it can be crippling. Recent research has shown that three out of every four

⁸¹ Tucker Bowe, *The Best Smart Alarm Clocks to Keep on Your Nightstand*, Gear Patrol (Dec. 7, 2020) <https://www.gearpatrol.com/tech/a590685/best-smart-alarm-clocks/> [https://perma.cc/85S8-WNA8].

⁸² Nicole Van Zantan, *Wake Up With These Smart Wifi Coffee Makers*, Ideaing, (July 24, 2020) <https://ideaing.com/ideas/best-smart-coffee-makers/> [https://perma.cc/23DK-YJV9].

⁸³ Elizabeth Heath, *Best Smart Refrigerators for 2020*, The Family Handyman (Sep. 16, 2020) <https://www.familyhandyman.com/list/best-smart-refrigerators/> [https://perma.cc/3V2F-DXTA].

⁸⁴ Erica Puisis, *The 8 Best Smart Washers and Dryers of 2020*, The Spruce (Nov. 11, 2020) <https://www.thespruce.com/best-smart-washers-and-dryers-4158885> [https://perma.cc/DLL2-RE59].

⁸⁵ Alex Colon & Angela Moscaritolo, *The Best Smart Light Bulbs for 2021*, PC Mag (Dec. 9, 2020) https://www.pcmag.com/picks/the-best-smart-light-bulbs?test_uuid=001OQhoHLBxsrrrMgWU3gQF&test_variant=a [https://perma.cc/2KC7-8KTY].

⁸⁶ Stephan Gossett, *IOT in Vehicles: A Brief Overview*, Builtin (Dec. 13, 2019) <https://builtin.com/internet-things/iot-in-vehicles> [https://perma.cc/9ZW4-WBGQ].

⁸⁷ See Nate Anderson, *What is DRM doing in my garage?*, Ars Technica (Dec. 16, 2009 9:30 PM) <https://arstechnica.com/tech-policy/2009/12/what-is-drm-doing-in-my-garage/> [https://perma.cc/3C8G-6NEX].

⁸⁸ John R. Delaney, *The Best Smart Thermostats for 2020*, PC Mag (Nov. 12, 2020) https://www.pcmag.com/picks/the-best-smart-thermostats?test_uuid=001OQhoHLBxsrrrMgWU3gQF&test_variant=a [https://perma.cc/898K-Z8QW].

⁸⁹ Brian Benchoff, *Cracking Litter Box DRM*, HACKADAY (Jan. 19, 2015) <https://hackaday.com/2015/01/19/cracking-litter-box-drm/> [https://perma.cc/86ZB-Z3X9].

⁹⁰ Amanda Capritto, *3 smart toothbrushes from CES 2020 you'll want this year*, Cnet (Jan. 10, 2020) <https://www.cnet.com/health/smart-toothbrushes-from-ces-2020-youll-want-this-year/> [https://perma.cc/8FND-VXSR].

⁹¹ Sellers, *supra* n. 16 at 1.

⁹² *All Categories of Smart Home Devices Forecast to Deliver Double Growth Through 2022 Says IDC*, Businesswire, (Oct. 1, 2018) <https://www.businesswire.com/news/home/20181001005167/en/All-Categories-of-Smart-Home-Devices-Forecast-to-Deliver-Double-Digit-Growth-Through-2022-Says-IDC> [https://perma.cc/HCR2-2XQ2] (“The worldwide smart home devices market is expected to grow 31% year over year in 2018 to 643.9 million shipments, according to the International Data Corporation”).

⁹³ Fredrik Dahlqvist et al., *Growing opportunities in the Internet of Things*, McKinsey (Jul. 22, 2019) <https://www.mckinsey.com/industries/private-equity-and-principal-investors/our-insights/growing-opportunities-in-the-internet-of-things#> [https://perma.cc/6LRJ-E3LZ] (“The number of businesses that use the IoT technologies has increased from 13 percent in 2014 to about 25 percent today. And the worldwide number of IoT-connected devices is projected to increase to 43 billion by 2023, an almost threefold increase from 2018.”).

American homeowners carried out at least one home improvement project in quarantine this year,⁹⁴ and many learned that the potential for TPM interference lurks in just about every aspect of a major home improvement project. Consumer tools from cordless power drills⁹⁵ to battery gauges,⁹⁶ to even toolboxes,⁹⁷ can all be software-enabled devices that may contain TPMs which require manufacturers' approval to repair.⁹⁸ Obtaining this approval becomes even more of a challenge when everyone is confined at home.

But the DIY crowd is far from the only group of users adversely impacted by TPMs and Section 1201⁹⁹ this year: millions of novice and professional chefs¹⁰⁰ may depend on software-enabled

⁹⁴ Porch Research, *Survey: Home Improvement Trends in the Time of Covid*, PORCH (Jul, 21, 2020), <https://porch.com/advice/home-improvement-trends-covid> [<https://perma.cc/4YWB-YYLF>] (“Over three in four (76%) homeowners in the United States have carried out at least one home improvement project since the start of the COVID pandemic, according to our survey”).

⁹⁵ Joe Iorillo, *Smart Technology Invades Power Tool Market*, Freedonia (May 24, 2017) <https://www.freedoniagroup.com/Content/Blog/2017/05/24/Smart-Technology-Invades-the-Power-Tool-Market> [<https://perma.cc/8B83-6C6L>].

⁹⁶ Jeff Kerns, *6 Power Tools for DIY Projects*, Machine Design (Dec. 13, 2016) <https://www.machinedesign.com/community/editorial-comment/article/21832155/6-smart-tools-for-diy-projects> (“Black & Decker’s technology and app (Android & iOS) also let users see the charge on multiple batteries . . . SmarTech also added a USB to the battery to make sure that your cellphone, tablet, or laptop are able to charge anywhere”) [<https://perma.cc/8G8R-EQTM>].

⁹⁷ *Toolbox*, CoolBox (product page displaying the toolbox’s smart features, including wireless Bluetooth speakers, AUX input connectivity, and USB ports) <https://www.getcoolboxcooler.com/products/toolbox> [<https://perma.cc/G3LX-Y7LL>] (last accessed Dec. 13, 2020).

⁹⁸ See Better Business Bureau, *Black and Decker (U.S.): Complaints*, Better Business Bureau (Oct. 12, 2020) <https://www.bbb.org/us/md/towson/profile/electric-tools/black-decker-us-inc-0011-1070/complaints> [<https://perma.cc/VJ95-Y9VT>] (“I have e-mailed Black and Decker for several months to comply to their warranty and repair my drill. . . Black and Decker will not reply to me but is pathetic enough to send me adds to my e-mail instead asking me to buy more products. After two months of emailing back and Decker and them refusing to answer me and repair my tool. I went to their website to get a address of one of their repair locations near me. . . After [. . .] finding them out in the county and the owner mowing the grass, Paul tells me he is no longer in business and has not been in business for about 7 years!”) [<https://perma.cc/VJ95-Y9VT>].

⁹⁹ See Jacob Silverman, *Just How ‘Smart’ Do You Want Your Blender to Be?*, New York Times (June 14, 2016) <https://www.nytimes.com/2016/06/19/magazine/just-how-smart-do-you-want-your-blender-to-be.html> [<https://perma.cc/7SZ6-CGRT>] (“Using a smart device for anything but the purposes explicitly sanctioned by its manufacturer risks violating a warranty, bricking a device or even breaking the law. (It’s fitting, albeit a touch melodramatic, that unauthorized tinkering with an iPhone is called “jailbreaking.”) The very same elements making these things smart — connectivity, sophisticated software, semiautonomous intelligence — can also make them more frustrating than any devices we’ve ever seen”)

¹⁰⁰ Amanda Hull, *Americans Have Baked All the Flour Away*, The Atlantic (May 12, 2020) <https://www.theatlantic.com/health/archive/2020/05/why-theres-no-flour-during-coronavirus/611527/>.

appliances like refrigerators,¹⁰¹ ovens,¹⁰² automated tea kettles,¹⁰³ blenders,¹⁰⁴ kitchen scales,¹⁰⁵ pressure cookers,¹⁰⁶ meat thermometers,¹⁰⁷ and dishwashers¹⁰⁸ to prepare meals. Yet, thanks to a combination of unprecedented postal delays and a sudden lack of access to manufacturer-approved retail options, many of these consumers must repair their devices themselves or with the help of a local independent repair technician to keep their kitchens functioning.¹⁰⁹

These restrictions have led to tragic effects for others as well. With over 300,000 deaths this year from COVID-19,¹¹⁰ some consumers are turning to smart devices to preserve images and videos of their recently deceased loved ones. However, thanks to the combination of TPMs, Section 1201, manufacturer restrictions on device repair, they cannot access this information once their

¹⁰¹ Heath, *supra* note 77.

¹⁰² Kristina Hacker, *6 Countertop Smart Ovens That Will Change the Way You Cook*, Remodelista (Mar. 14, 2019) <https://www remodelista.com/posts/countertop-smart-ovens-kitchen-appliances/> [<https://perma.cc/MBS3-R4Z7>] (“[T]he market seems to be exploding with cooking gadgets that take the guesswork out of roasting, let you control the temperature from your phone, and even claim to replace all your countertop appliances”).

¹⁰³ Jordan Carter, *8 Best Smart Kettles (Review) in 2020*, Gear Hungry (May 21, 2020 10:34AM), <https://www.gearhungry.com/best-smart-electric-kettle/> [<https://perma.cc/8MXM-T5P6>] (“[T]oday’s smart kettles are fully programmable allowing you to pick the time you want the water heated, the exact temperature you want the water heated to and how long you want it to maintain that temperature”).

¹⁰⁴ Lee Bell, *NutriBullet Balance: A Connected Blender That Gives You Real Time Nutrition Data on Your Smartphone*, Forbes (Jul. 31, 2018) <https://www.forbes.com/sites/leebelltech/2018/07/31/nutribullet-balance-a-connected-blender-that-gives-you-real-time-nutrition-data-on-your-smartphone/?sh=45ae44f43dce> [<https://perma.cc/Q6QW-U67K>].

¹⁰⁵ *Drop Scale – Connected Kitchen Scale and Step-by-Step Recipes*, Amazon, https://www.amazon.com/Drop-Scale-Connected-Step-Step/dp/B00TTY34KG/ref=as_li_ss_tl?ots=1&slotNum=21&imprToken=febb2fe2-e3d5-2efb-8da&keywords=Drop+Scale+-+Connected+Kitchen+Scale+and+Step-by-Step+Recipe+App&qid=1578434163&s=home-garden&sr=1-1&linkCode=ll1&tag=biip_010720_smart-kitchen-appliances-20&linkId=baeb069fe5485bafb8b6610976c7523d&language=en_US [<https://perma.cc/8GU5-2W2B>] (last accessed Dec. 13, 2020).

¹⁰⁶ Connie Chen, *11 smart kitchen appliances that pair with helpful apps to make cooking easier*, Business Insider (Jan 21, 2020 11:30 AM), <https://www.businessinsider.com/smart-kitchen-appliances> [<https://perma.cc/BQ9F-MRVK>] (“It’s all the versatility and ease of use of a classic Instant Pot multicooker, with the additional benefits of WiFi access and a hands-free voice assistant”).

¹⁰⁷ *Id.* (“This smart thermometer has an outdoor wireless range of 200 feet and sends you a notification and alarm when your meat reaches the set temperature”).

¹⁰⁸ Britta O’Boyle, *Best smart dishwashers 2020: The technology making cleaning dishes easier*, Pocket Lint (Nov. 5, 2020) <https://www.pocket-lint.com/smart-home/buyers-guides/146405-best-smart-dishwashers> [<https://perma.cc/DB2Y-YR38>].

¹⁰⁹ Soo Yoon, *Ovens, dishwashers, and washing machines are breaking down like never before. But there’s nobody to fix them*, Wash. Post (Oct. 22, 2020 7:36 AM), <https://www.washingtonpost.com/road-to-recovery/2020/10/22/appliance-repair-services-pandemic/> [<https://perma.cc/F7FX-GY3G>] (“Amid the general collapse of the service economy during the pandemic — think retail or restaurants — appliance repair technicians are seeing explosive demand for their services as families adjust to living at home 24/7, sometimes with adult children, elderly parents or in-laws expanding households and putting more wear and tear on refrigerators and dishwashers”).

¹¹⁰ *Coronavirus in the U.S.: Latest Map and Case Count*, New York Times (Dec. 14, 2020 12:18 AM2:30 PM) <https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html> [<https://perma.cc/K932-CPGR>] (reporting the number of deaths in the U.S. due to COVID-19 as 299,328).

devices, like phones (exempt under current rules) and tablets (not exempt under current rules), are damaged.¹¹¹

While some manufacturers may offer limited repair services, few offer repair services that have the time or specialized skills to recover this data, explains Jessa Jones. Jones is a third-party contractor who specializes in recovering images and videos of deceased loved ones from damaged smart devices like iPads using microsoldering, a technique that fuses metal components together on a microscopic level using extremely high heat.¹¹² In some instances, device manufacturers won't even step in to repair the devices at the request of law enforcement agencies, leaving repairpersons like Jones as the only options for crucial data recovery.¹¹³ Jessa Jones noted before the Boston Legislature that she has seen new software locks implemented with new smartphones, that will effectively prevent repair, such as one that pairs the home button to the mainboard of the phone.¹¹⁴

Further, the combination of TPMs, § 1201's prohibition on circumvention, and the lack of third-party repair options hinders device users' personal autonomy. Consumers who depend upon software-enabled devices like motorized wheelchairs,¹¹⁵ CPAP machines,¹¹⁶ hearing aids,¹¹⁷ blood glucose monitors,¹¹⁸ and even breast milk pumps¹¹⁹ could find themselves without a much needed device while they wait for manufacturers' repair services that may be exorbitantly expensive or significantly delayed, if they are available at all. Blood glucose monitors, for example, which use software to report data on its owners' bodily systems, do not allow the owners to calibrate the monitor to increase reporting accuracy as the sensors age, without the approval of the manufacturer.¹²⁰ Likewise, certain hearing aids don't allow their owners to access the complete suite of device calibration settings without verification through the manufacturer.¹²¹ Owners of these devices are clearly adversely impacted by the combination of TPMs and § 1201.

¹¹¹ Joe Keegan, *Why Can't I Fix My Own Phone, Toaster, or Tractor?*, The Markup (Oct. 20, 2020, 8:00 AM) <https://themarkup.org/ask-the-markup/2020/10/20/0-electronics-right-to-repair-ventilators-iphone> [<https://perma.cc/J8FQ-TEGL>].

¹¹² *Id.*

¹¹³ Jessa Jones, AN INCREDIBLY SAD CASE: IPAD 4 FOUND ON BODY OF DECEASED HIKER, YouTube (Dec. 5, 2019) <https://www.youtube.com/watch?v=zMuap2fgGuY> [<https://perma.cc/3E56-PV5H>].

¹¹⁴ Jessa Jones, JESSA JONES OF IPAD REHAB SPEAKS AT BOSTON LEGISLATURE, YouTube (Oct. 29, 2019) https://www.youtube.com/watch?v=yqRMrRUQE_o [<https://perma.cc/8DR4-NUQV>].

¹¹⁵ *DX/DX2 Power Wheelchair Control System*, Dynamic, <https://www.dynamiccontrols.com/our-products/dx2> [<https://perma.cc/A8U3-6TTZ>] (last accessed Dec. 13, 2020).

¹¹⁶ *Maquet Servo-i service manual*, iFixIt, <https://www.ifixit.com/Document/jpuqR1CDDumFeves/Maquet-Servo-i-Service-Manual.pdf> [<https://perma.cc/UJQ7-ZR3B>].

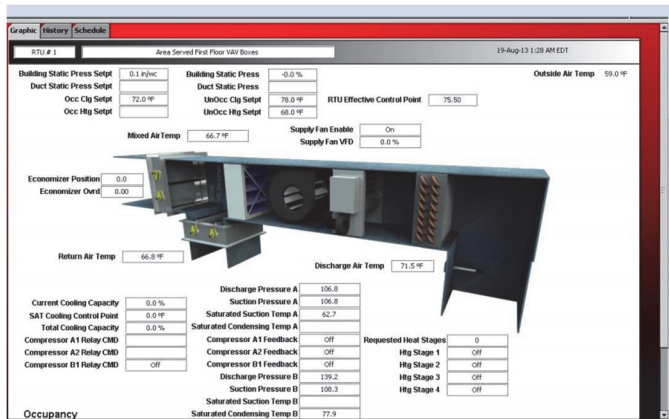
¹¹⁷ OTICON DEVICE MANUAL, *supra* note 48.

¹¹⁸ See Cory Doctorow, *Abbott Labs kills free tool that lets you own the blood-sugar data from your glucose monitor, saying it violates copyright law*, Boing Boing (Dec. 12, 2019) <https://boingboing.net/2019/12/12/they-literally-own-you.html> [<https://perma.cc/5AF4-5YYQ>].

¹¹⁹ Willow, *Willow Product Details*, Willow, <https://shop.willowpump.com/pages/buy> [<https://perma.cc/2ZSF-YH72>] (last accessed Dec. 13, 2020) (describing the breast pump's software-enabled features including its complimentary app, compatibility with Android and iOS, and its "Smart Suction technology").

¹²⁰ Doctorow, *supra* note 120 ("The admin of Diabettech posted technical instructions and code for extracting your blood-sugar data from the Librelink so that you could use a different "listener" app with your data, or even connect it to an insulin pump to create an artificial pancreas loop. . . In response, Abbott Labs used US copyright law to have the project deleted from Github, censoring Diabettech's code and instructions").

¹²¹ OTICON DEVICE MANUAL, *supra* note 48.



Similar harms can be seen in industrial settings. For instance, many of the Facility Management Systems that run commercial buildings, like the one pictured to the left, have TPMs built into them by necessity, as the systems are responsible for controlling access to the buildings. They require password authentication to make programming changes. But, if the building owner needs to reset the master password in the event of an employee departure or death,¹²² the manufacturer approved

pathway necessitates resetting all of the device’s programming. This mass programming reset shuts the entire system down, rendering the building’s HVAC, locks, and water treatment systems, among others, non-operational. Bypassing the Facility Management System's TPM¹²³ and simply changing the password is a far less disruptive and costly repair.

Similarly, TPMs also complicate repairs for supervisory control and data acquisition (SCADA) systems, which facilitate the simultaneous operation of industrial machinery used in factories, power plants, pipelines, and other large industrial systems.¹²⁴ Siemens hard-coded a default password into their SCADA systems, and malware began circulating utilizing this password.¹²⁵ Wired reports that, “The password appears to be used by the WinCC software to connect to its MS-SQL back-end database. According to some of the forum posts, changing the password causes the system to stop working.”¹²⁶ Systems operators were faced with a choice: disconnect the hardware from the internet and wait for a Siemens patch, or bypass the Siemens security model and develop a patch for these systems themselves. Wired’s investigation found that “hard-coded passwords aren't a problem just for Siemens.”¹²⁷

When hackers utilized the system’s master passwords to install malware, factory owners were unable to repair their own systems and were forced to disconnect the hardware from the internet, effectively restoring all the programs to their factory settings.¹²⁸ Circumventing these TPMs would allow repairers to add in a software patch to address these cybersecurity threats without wiping out the owner’s extensive custom settings. “Well over 50 percent of the control system suppliers” hard-code passwords into their software or firmware, says Joe Weiss, author of the book *Protecting Industrial Control Systems from Electronic Threats*.¹²⁹ “These systems were

¹²² NAE25 Metasyssyagent Password Reset, HVAC Talk (Jan. 17, 2008) <https://hvac-talk.com/vbb/showthread.php?159467-NAE25-Metasyssyagent-Password-Reset> [<https://perma.cc/JHU5-ECDQ>].

¹²³ See e.g. Billy Rios, *Owning a Building: Exploiting Access Control and Facility Management Systems*, Qualys <https://www.blackhat.com/docs/asia-14/materials/Rios/Asia-14-Rios-Owning-A-Building-Exploiting-Access-Control-And-Facility-Management.pdf> [<https://perma.cc/BF4Y-8C2Y>] (last accessed Dec. 14, 2020).

¹²⁴ Kim Zetter, *SCADA System's Hard-Coded Password Circulated Online for Years*, Wired (July 19, 2010) <https://www.wired.com/2010/07/siemens-scada/> [<https://perma.cc/2RD6-EBDQ>].

¹²⁵ See, e.g., *id.*

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ See, e.g., *Id.*

¹²⁹ *Id.*

designed so they could be used efficiently and safely. Security was simply not one of the design issues.”¹³⁰

The restrictive impact that TPMs and Section 1201 have on operational systems also extends to marine engines, satellite telephones, and PBX telephone systems. Computer-controlled diesel engines for yachts and ships for instance, manufactured by companies like John Deere, Caterpillar, Kohler Power, often contain TPMs that prevent owners and technicians from performing diagnostics or resetting alerts.¹³¹ As a result, engine operators encountering these restrictions are prevented from accessing critical, real-time engine diagnostic information about their own vessels. Likewise, Garmin’s Pumac satellite phone, uses TPMs to preclude users from customizing their own devices’ settings without manufacturer approval.¹³² These anti-consumer and anti-competitive practices have not gone unnoticed by courts. Avaya, a manufacturer of PBX telephone systems, was found liable for antitrust violations for preventing third-party repairs.¹³³ And, with a 16.7% increase in growth for software-enabled industrial systems on the horizon by 2027, it’s only a matter of time before manufacturer approval will be required at the expense of the device’s owners at all stages of the supply chain.¹³⁴

The Copyright Office Should Not Consider Non-Copyright-Related Arguments Against or Limitations on Exemptions

In previous proceedings, the Copyright Office has recommended, and the Librarian adopted, exemptions that only apply in the absence of other, non-copyright regulations. One of the current repair exemptions, for example, is limited to situations “where such circumvention does not constitute a violation of applicable law, including without limitation regulations promulgated by the Department of Transportation or the Environmental Protection Agency.”¹³⁵ The Copyright Office should decline to do so here.

Just as the FDA does not condition its regulations on compliance with copyright law, copyright law and regulations should not be conditioned on areas in which the Copyright Office lacks expertise. The concerns and motivations for these other areas of law have nothing to do with the protection and promotion of creative works, and they should not be the basis for a decision of the Copyright Office.

Critically, a broadly crafted exemption allowing owners to repair their software-enabled devices would not eliminate remedies for violations of existing law, regulations, or even breach of

¹³⁰ *Id.*

¹³¹ See e.g. Kohler Operation Manual, *supra* note 49.

¹³² GARMINPHONE OWNER’S MANUAL, *supra* note 27.

¹³³ See *Avaya Inc., RP v. Telecom Labs, Inc.*, *supra* note 29.

¹³⁴ Meticulous Market Research Pvt. Ltd, *Industrial IoT (IoT) Market Worth \$263.4 billion by 2027- Exclusive Report Covering Pre and Post COVID-19 Market Analysis and Forecasts by Meticulous Research*, GlobeNewswire (June 19, 2020 10:44AM) <https://www.globenewswire.com/news-release/2020/06/19/2050758/0/en/Industrial-IoT-IIoT-Market-Worth-263-4-billion-by-2027-Exclusive-Report-Covering-Pre-and-Post-COVID-19-Market-Analysis-and-Forecasts-by-Meticulous-Research.html> [<https://perma.cc/QEJ8-FBJL>] (noting that the industrial market for software-enabled devices that use the internet to design, maintain, monitor, optimize, and analyze industrial operations is expected to grow at a compound average growth rate (CAGR) of 16.7% from 2019 to 2027).

¹³⁵ 37 C.F.R. § 201.40(b)(9).

contract.¹³⁶ In 2016, the Copyright Office acknowledged that some business models restrict device repair, but that granting an exemption would not affect manufacturers’ ability to create and enforce those business models through contract or other law. It will simply eliminate the threat of violating copyright law for doing something—repairing a device—that fundamentally does not implicate copyright interests.¹³⁷

The Expanded Exemption Can and Should Permit Third-Party Assistance

The Copyright Office has recognized that exemptions issued under Section 1201(c) can extend to third parties working on behalf of a device owner to assist the device owner in circumventing TPMs. As the Office noted in its Section 1201 Study Final Report, the exemption for assistive technology only requires that the device be lawfully acquired by a person with disabilities; it does not require that person to be the one actually doing the circumventing.¹³⁸ We agree with this Office that the statute’s use of the term ”user” instead of ”owner” creates this possibility. Additionally, the current exemption for wireless device unlocking provides that circumvention “may be initiated... by another person at the direction of the owner.”¹³⁹ The Office should recommend an exemption that, like the Proposed Expanded Exemption, allows a third party to perform the circumvention as that device’s ”user.”

The Statutory Factors Favor Granting the Proposed Expanded Exemptions

The Copyright Office has also requested that we address the five statutory factors:

- (i) the availability for use of copyrighted works;
- (ii) the availability for use of works for nonprofit archival, preservation, and educational purposes;
- (iii) the impact that the prohibition on the circumvention of technological measures applied to copyrighted works has on criticism, comment, news reporting, teaching, scholarship, or research;
- (iv) the effect of circumvention of technological measures on the market for or value of copyrighted works; and
- (v) such other factors as the Librarian considers appropriate.

The Copyright Office’s previous review of these statutory factors as they relate to device repair is informative. Although in 2018 the Copyright Office separated the devices by category and largely eliminated various devices for which it did not find sufficiently specific evidence, for all those narrow device classes where the Office noted specific evidence of harm,¹⁴⁰ namely vehicle

¹³⁶ See, e.g., *ProCD, Inc. v. Zeidenberg* 86 F.3d 1447, 1450 (7th Cir. 1996) (holding that a user who violated a software program’s license was still liable to the manufacturer for breach of contract, agnostic of any applicable infringement claims).

¹³⁷ 2016 Software Study 44

¹³⁸ 2017 Copyright Office Report 61.

¹³⁹ 37 C.F.R. § 201.40(c).

¹⁴⁰ See 2018 Acting Register’s Recommendations 216-220.

telematics systems, home appliances, and smartphones, there Office weighed the factors in favor of repair.¹⁴¹ This same analysis applies to all of the devices at issue here.

“The first statutory factor favors an exemption, as [repair] extends the useful life of the devices by facilitating repair and restoration of device functionality. The record demonstrates there are times where manufacturer-authorized repair channels are insufficient to address widespread consumer problems in a timely manner or to address the issue at all, and also suggests that circumvention is necessary to engage in activities of self-repair.”¹⁴²

The second and third factors “weigh slightly in favor of a determination that TPMs have an adverse effect on the proposed uses.”¹⁴³ This, as we noted in the previous section, is because the nature of repair and self-repair options enable hand-on-learning and research into the nature and function of devices.

As for the fourth factor, “the purpose of diagnosis and repair is to restore the intended functionality of the device, and not to modify expressive works. There is little [evidence] to suggest that engaging in these activities will negatively affect the value of copyrighted works.”¹⁴⁴ Thus, “the fourth factor favors exemption with regard to diagnosis and repair”¹⁴⁵ of devices.

The fifth factor also favors a broad exemption for repair of software enabled devices that extends to third party assistance. Increasing consumer access to repair technicians by expanding all repair exemptions to clarify that they extend to third-party assistance will not only make it possible for consumers to take advantage of these exemptions in a meaningful way, it will also reduce the amount of environmental waste generated when broken devices are disposed of, and also expands crucial domestic job opportunities. This year, the EPA estimated that the recycling and reuse industry activities in 2019 contributed approximately 681,000 jobs, \$37.8 billion dollars in wages, and \$5.5 billion in tax revenue to the US economy.¹⁴⁶ Electronics technicians, in particular, represent 121,000 of those jobs in the U.S. as of 2019.¹⁴⁷ If refurbishing and recycling rates in America increase, this industry has the potential to turn into an even more significant source of domestic jobs. With over 25% of U.S. adults reporting household job loss due to COVID-19, and over 32% reporting a household pay cut due to the pandemic,¹⁴⁸ the repair industry’s potential as a catalyst for more domestic job opportunities is one that should not be

¹⁴¹ *Id.* at 221.

¹⁴² *Id.* at 221.

¹⁴³ *Id.*

¹⁴⁴ *Id.* at 221-22.

¹⁴⁵ *Id.* at 222.

¹⁴⁶ United States Environmental Protection Agency, *Recycling Economic Information (REI) Report 1* (2020) https://www.epa.gov/sites/production/files/2020-11/documents/rei_report_508_compliant.pdf [<https://perma.cc/R37B-P982>] (“In summary, the 2020 REI Report found . . . 681,000 jobs, \$37.8 billion in wages, and \$5.5 billion in tax revenue generated”); See e.g. also Kyle Wiens, *One Way to Create American Jobs: Fix Our 5 Million Tons of Out-Of-Use Electronics*, *The Atlantic* (Oct. 31, 2012) <https://www.theatlantic.com/technology/archive/2012/10/one-way-to-create-american-jobs-fix-our-5-million-tons-of-out-of-use-electronics/264351/> [<https://perma.cc/V64Q-QEUK>].

¹⁴⁷ U.S. Bureau of Labor Statistics, *Electrical and Electronics Installers and Repairers*, Occupational Outlook Handbook (2019) <https://www.bls.gov/ooh/installation-maintenance-and-repair/electrical-and-electronics-installers-and-repairers.htm> [<https://perma.cc/D49Z-P6CP>].

¹⁴⁸ Kim Parke et al., *Economic Fallout from COVID-19 Continues To Hit Lower-Income Americans the Hardest*, Pew Res. Ctr. (Sept. 24, 2020) <https://www.pewsocialtrends.org/2020/09/24/economic-fallout-from-covid-19-continues-to-hit-lower-income-americans-the-hardest/> [<https://perma.cc/H6YN-WM49>].

ignored, particularly when hands-on repair experience is a prerequisite for qualifying for many of these opportunities. “There aren’t enough appliance service technicians because there are very few formal training schools available,” Corrine D. Caruso, the president of the United Appliance Servicers Association, recently explained, “The majority have learned on the job.”¹⁴⁹

The adverse impact of Section 1201’s prohibition on circumvention for the purpose of repair extends beyond the owner of the device, and will have ripple effects far beyond 2020.

Manufacturing a new device requires large amounts of pollution-causing sources of energy; this currently constitutes the most environmental impact a product will have during its lifecycle.¹⁵⁰

Mining and manufacturing raw materials for the latest iPhone, for instance, represents about 83% of the product’s total contribution to heat-trapping emissions in the atmosphere.¹⁵¹ This means that simply purchasing a new iPhone, rather than repairing an old one, already contributes over two-thirds of the carbon emissions that the product releases into the atmosphere over the course of its use. And this trend isn’t limited to personal electronics: just the materials and manufacturing process for washing machines, for example, produce 57% of the device’s aggregate carbon footprint before a consumer even uses them.¹⁵²

Conclusion

For the above reasons, Commenters respectfully request that the Copyright Office recommend and the Librarian grant the expanded and clarified exemption covering repair of all lawfully acquired software-enabled devices.

¹⁴⁹ Yoon, *supra* note 125.

¹⁵⁰ Grace Z. Li, ‘Silicon Mountain’ Advocates for More Tech Re-Use, SF WEEKLY (Nov. 17, 2020 3:05 PM) <https://www.sfweekly.com/film/silicon-mountain-advocates-for-more-tech-re-use/> [<https://perma.cc/S7SJ-TULG>].

¹⁵¹ Apple, *Product Environmental Report: iPhone 12*, APPLE 1, 2 (October 13, 2020) https://www.apple.com/environment/pdf/products/iphone/iphone_12_PER_Oct2020.pdf [<https://perma.cc/8TVU-VN9G>].

¹⁵² Jianhua Chen et al., *Product carbon footprint assessment supporting the green supply chain construction in household appliance manufacturers*, 94 IOP Conf. Ser.: Earth Environ. Sci. 1, 2 (2017).