



SATA Firmware Update Instructions



Ironwolf SATA STD 512E firmware update version **SC61**

This firmware update is for the Seagate **Ironwolf SATA** family only.

Backup all data contained on the drive prior to running the update.

See the End User License Agreement below for specific information about these software tools.

This firmware release only supports the following models:

Ironwolf SATA STD 512E (Tatsu)

Models	Part number	Firmware File
ST10000VN0004	1ZD101-500	TatsulronwolfSATA-STD-512E-SC61.LOD

Note: The firmware above does NOT support SAS, SED. It is only for the one model in the list above.

STD Standard (also known as Secure Download & Diagnostic (SD&D))
SED Self Encrypting Drive
FIPS Federal Information Processing Standard
4kN 4k Native sector size
5xxE Advanced Format (512 byte emulation from 4k physical)

If your current **Ironwolf SATA** firmware does not begin with the digits "**SC60**" then you have a configuration which is not compatible with **SC61**. Otherwise, you might have a unique OEM version in which case please contact your OEM for firmware updates for these drives.

Warning, possible loss of data if this firmware is downloaded to unsupported models!

DO NOT run this firmware update on RAID systems.

DO NOT turn the power off during the firmware update procedure.

BEFORE YOU BEGIN:

1. Make sure you have backed up all of your important files and critical data.
2. Save any work in progress.
3. Close all other open applications.
4. Disconnect all external storage devices.

Always handle the drive carefully so you do not cause internal damage to the circuitry inside the drives. Drives are sensitive devices.

A warning about RAID

RAID systems are extremely sensitive to disruptions to individual drives. It is not uncommon for low level disk drive diagnostics to cause RAID management software to fault a drive that is slowed down by testing or firmware download. For this reason, we highly recommend that you use disk management tools provided by your RAID controller manufacturer if they are available. If these tools are not available, you might consider taking the RAID offline to a maintenance mode or rebooting the system to temporary bootable media and running diagnostics from there. Seagate recommends that you use disk utility tools provided by your RAID controller manufacturer.

Among others, RAID management software may be available from Adaptec and Broadcom (formerly Avago and LSI).

Here are the instructions for updating SATA firmware:

The method you choose to update the firmware on the drive will depend on your operating system, system utilities or work bench environment.

Bootable Tools

Windows operating systems do not tolerate firmware downloads to SATA drives while Windows is running. In this case, we recommend that you prepare the bootable bootable USB flash drive solution. Bootable tools are the obvious choices for new, unformatted drives.

- The bootable USB setup tool is a Windows EXE which formats the USB flash drive and copies all the necessary firmware files. (All previous data on the USB flash drive will be lost.)

Bootable tools are the best choice when downloading firmware to multiple drives. Attach the drive(s) to be updated to a non-RAID SATA controller (JBOD). An embedded SATA controller on the motherboard works best. Attach the first drive to Port 0 of the SATA controller. If doing multiple drives at once, we recommend no more than 4 drives at a time off one PC.

Command Line Interface Tools

SeaChest_Firmware is available for firmware download. SeaChest_Firmware is available for both Linux and Windows and they share the same command line structure. These tools have extensive documentation available.

Note: Windows operating systems do NOT allow firmware download to SATA drives unless the drives support the Deferred Download mode.

SeaChest_Firmware is our most current tool. The Linux version is shown below. The Windows version does not reference devices as “/dev/sg” but rather as PDx. Please see the SeaChest_Firmware for Windows documentation for specific examples.

```
=====
SeaChest_Firmware - Seagate drive utilities - NVMe Enabled
Copyright (c) 2014-2019 Seagate Technology LLC and/or its Affiliates
SeaChest_Firmware Version: 2.7.0-1_19_23 X86_64
Build Date: Jun 10 2019
=====
Usage
=====
    SeaChest_Firmware [-d <sg_device>] {arguments} {options}

Examples
=====
    SeaChest_Firmware --scan
    SeaChest_Firmware -d /dev/sg2 -i
    SeaChest_Firmware -d /dev/sg2 --fwdlInfo
    SeaChest_Firmware -d /dev/sg2 --downloadFW fwfilename
    SeaChest_Firmware -d /dev/sg2 --fwdlConfig configfile.cfs

Utility Arguments
=====
    -d, --device deviceHandle
    -F, --scanFlags [option list]
    -i, --deviceInfo
    -s, --scan
    -S, --Scan
    --SATInfo
    --testUnitReady
    --activateFW      (Seagate Only)
    --calculateFileHash [file]
    --downloadFW [firmware_filename] (Seagate Only)
    --downloadMode [ full | segmented | deferred ] (Seagate Only)
    --firmwareSlot/--fwBufferID slot# (Seagate Only)
    --fwdlConfig [config file] (Seagate Only)
    --fwdlDryRun
    --fwdlSegSize [segment size in 512B blocks] (Seagate Only)
    --fwdlInfo
    --switchFW      (NVMe Only) (Seagate Only)
```

```
Utility Options (partial listing)
=====
-h, --help
-V, --version
--license
```

First, run the `--scan` option to determine what `/dev/sg#` assignment lines up to your disk drive. This option also will show you other details about the drive including the current firmware revision. Like this:

Vendor	Handle	Model Number	Serial Number	FwRev
ATA	/dev/sg0	ST94813AS	3AA043KP	3.03
SEAGATE	/dev/sg1	ST1000NM0011	ZAA15VAS	SN03

The typical ordinary command line looks something like this:

```
SeaChest_Firmware -d /dev/sg2 --downloadFW fwfilename
```

`--modelMatch` is a model number verification based on the device Inquiry response. `--modelMatch` scans all sg devices on the system.

The tool has two batch modes, which can be used thusly:

```
SeaChest_Firmware -d all --modelMatch <model_number> --downloadFW fwfilename
```

Note: Use of `-d all --modelMatch` mode is preferred for batch processing of sg (SCSI generic) SAS disk drives. The `--modelMatch` mode may also be used on Enterprise SATA disk drives. Desktop and notebook SATA drives firmware is usually combined with a Seagate-prepared CFS firmware configuration file.

The `<cfs_file>` noted above is a Seagate-prepared compatible firmware selector file which is used to match up the right firmware for a particular SATA drive.

```
SeaChest_Firmware -d /dev/sg2 --fwdlConfig configfile.cfs
```

Note: Batch processing of SATA drives should use a Seagate prepared CFS file.

Both of these modes assume that the relevant firmware files are located in the current working directory.

See the `SeaChest_Firmware.-Lin.txt` file for a complete description of the software.

Raw Firmware Data Files

You will need the Seagate firmware file to run the simple command line Linux tool. This file will have the `.LOD` filename extension and should be located in the current working directory. This firmware file should never be used outside of the specific product family

models and part numbers listed with the firmware release. Incorrect usage of the .LOD may result in data loss or even product failure. Seagate Technology is not responsible for lost user data. See the End User License Agreement below for specific information about these software tools.

Using Traditional Linux Firmware Tools

For SATA drive firmware downloads you might use the Linux "hdparam" command.

Support

Seagate offers technical support for disk drive installation. If you have any questions related to Seagate products and technologies, feel free to submit your request on our web site. See the web site for a list of world-wide telephone numbers.

Seagate Support: <http://www.seagate.com/support-home/>
Contact Us: <http://www.seagate.com/contacts/>

This software uses open source packages obtained with permission from the relevant parties. For a complete list of open source components, sources and licenses, please see our Linux USB Boot Maker Utility FAQ for additional information.

Linux USB Boot Maker FAQ:
http://support.seagate.com/seachest/SeaChest_Combo_UserGuides.html

Copyright © 2019 Seagate Technology LLC and/or its Affiliates,. All rights reserved.

END USER LICENSE AGREEMENT

FOR SEAGATE SOFTWARE

PLEASE READ THIS END USER LICENSE AGREEMENT (“EULA”) CAREFULLY. BY CLICKING “I AGREE” OR TAKING ANY STEP TO DOWNLOAD, SET-UP, INSTALL OR USE ALL OR ANY PORTION OF THIS PRODUCT (INCLUDING, BUT NOT LIMITED TO, THE SOFTWARE AND ASSOCIATED FILES (THE “SOFTWARE”), HARDWARE (“HARDWARE”), DISK (S), OR OTHER MEDIA) (COLLECTIVELY, THE “PRODUCT”) YOU AND YOUR COMPANY ACCEPT ALL THE TERMS AND CONDITIONS OF THIS EULA. IF YOU ACQUIRE THIS PRODUCT FOR YOUR COMPANY’S USE, YOU REPRESENT THAT YOU ARE AN AUTHORIZED REPRESENTATIVE WHO HAS THE AUTHORITY TO LEGALLY BIND YOUR COMPANY TO THIS EULA. IF YOU DO NOT AGREE, DO NOT CLICK “I AGREE” AND DO NOT DOWNLOAD, SET-UP, INSTALL OR USE THE SOFTWARE.

1. Ownership. This EULA applies to the Software and Products of Seagate Technology LLC and the affiliates controlled by, under common control with, or controlling Seagate Technology LLC, including but not limited to affiliates operating under the LaCie name or brand, (collectively, “Seagate”, “we”, “us”, “our”). Seagate and its suppliers own all right, title, and interest in and to the Software, including all intellectual property rights therein. The Software is licensed, not sold. The structure, organization, and code of the Software are the valuable trade secrets and confidential information of Seagate and its suppliers. The Software is protected by copyright and other intellectual property laws and treaties, including, without limitation, the copyright laws of the United States and other countries. The term “Software” does not refer to or include “Third-Party Software”. “Third-Party Software” means certain software licensed by Seagate from third parties that may be provided with the specific version of Software that you have licensed. The Third-Party Software is generally not governed by the terms set forth below but is subject to different terms and conditions imposed by the licensors of such Third-Party Software. The terms of your use of the Third-Party Software are subject to and governed by the respective license terms, except that this Section 1 and Sections 5 and 6 of this Agreement also govern your use of the Third-Party Software. You may identify and view the relevant licenses and/or notices for such Third-Party Software for the Software you have received pursuant to this EULA at <http://www.seagate.com/support/by-topic/downloads/> , or at <http://www.lacie.com/support/> for LaCie branded product. You agree to comply with the terms and conditions contained in all such Third-Party Software licenses with respect to the applicable Third-Party Software. Where applicable, the URLs for sites where you may obtain source code for the Third Party Software can be found at <http://www.seagate.com/support/by-topic/downloads/>, or at <http://www.lacie.com/support/> for LaCie branded product.

2. Product License. Subject to your compliance with the terms of this EULA, Seagate grants you a

personal, non-exclusive, non-transferable, limited license to install and use one (1) copy of the Software on one (1) device residing on your premises, internally and only for the purposes described in the associated documentation. Use of some third party software included on the media provided with the Product may be subject to terms and conditions of a separate license agreement; this license agreement may be contained in a “Read Me” file located on the media that accompanies that Product. The Software includes components that enable you to link to and use certain services provided by third parties (“Third Party Services”). Your use of the Third Party Services is subject to your agreement with the applicable third party service provider. Except as expressly stated herein, this EULA does not grant you any intellectual property rights in the Product. Seagate and its suppliers reserve all rights not expressly granted to you. There are no implied rights.

2.1 Software. You are also permitted to make a single copy of the Software strictly for backup and disaster recovery purposes. You may not alter or modify the Software or create a new installer for the Software. The Software is licensed and distributed by Seagate for use with its storage products only, and may not be used with non-Seagate storage product.

3. Restrictions. You are not licensed to do any of the following:

- a. Create derivative works based on the Product or any part or component thereof, including, but not limited to, the Software;
- b. Reproduce the Product, in whole or in part;
- c. Except as expressly authorized by Section 11 below, sell, assign, license, disclose, or otherwise transfer or make available the Product, in whole or in part, to any third party;
- d. Alter, translate, decompile, or attempt to reverse engineer the Product or any part or component thereof, except and only to the extent that such activity is expressly permitted by applicable law notwithstanding this contractual prohibition;
- e. Use the Product to provide services to third parties;
- f. Take any actions that would cause the Software to become subject to any open source license agreement if it is not already subject to such an agreement; and
- g. Remove or alter any proprietary notices or marks on the Product.

4. Updates. If you receive an update or an upgrade to, or a new version of, any Software (“Update”) you must possess a valid license to the previous version in order to use the Update. All Updates provided to you shall be subject to the terms and conditions of this EULA. If you receive an Update, you

may continue to use the previous version(s) of the Software in your possession, custody or control. Seagate shall have no obligation to support the previous versions of the Software upon availability of an Update. Seagate has no obligation to provide support, maintenance, Updates, or modifications under this EULA.

5. NO WARRANTY. THE PRODUCT AND THE THIRD-PARTY SOFTWARE ARE OFFERED ON AN “AS-IS” BASIS AND NO WARRANTY, EITHER EXPRESS OR IMPLIED, IS GIVEN. SEAGATE AND ITS SUPPLIERS EXPRESSLY DISCLAIM ALL WARRANTIES OF ANY KIND, WHETHER STATUTORY, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT. SEAGATE DOES NOT PROVIDE THE THIRD PARTY SERVICES AND MAKES NO WARRANTIES WITH RESPECT TO THE THIRD PARTY SERVICES. YOUR USE OF THE THIRD PARTY SERVICES IS AT YOUR RISK.

6. EXCLUSION OF INCIDENTAL, CONSEQUENTIAL, AND CERTAIN OTHER DAMAGES. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, IN NO EVENT SHALL SEAGATE OR ITS LICENSORS OR SUPPLIERS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, PUNITIVE, INDIRECT, OR CONSEQUENTIAL DAMAGES WHATSOEVER (INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF PROFITS OR CONFIDENTIAL OR OTHER INFORMATION, FOR BUSINESS INTERRUPTION, FOR PERSONAL INJURY, FOR LOSS OF PRIVACY, FOR FAILURE TO MEET ANY DUTY INCLUDING OF GOOD FAITH OR REASONABLE CARE, FOR NEGLIGENCE, AND FOR ANY OTHER PECUNIARY OR OTHER LOSS WHATSOEVER) ARISING OUT OF OR IN ANY WAY RELATED TO THE USE OF OR INABILITY TO USE THE PRODUCT OR ANY PART OR COMPONENT THEREOF OR RELATED SERVICE OR ANY THIRD PARTY SERVICES, OR OTHERWISE UNDER OR IN CONNECTION WITH ANY PROVISION OF THE EULA, EVEN IN THE EVENT OF THE FAULT, TORT (INCLUDING NEGLIGENCE), MISREPRESENTATION, STRICT LIABILITY, BREACH OF CONTRACT, OR BREACH OF WARRANTY OF SEAGATE OR ITS LICENSORS OR SUPPLIERS, AND EVEN IF SEAGATE OR ITS LICENSOR OR SUPPLIER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND NOTWITHSTANDING ANY FAILURE OF THE ESSENTIAL PURPOSE OF THIS AGREEMENT OR ANY REMEDY.

7. LIMITATION OF LIABILITY. NOTWITHSTANDING ANY DAMAGES THAT YOU MIGHT INCUR FOR ANY REASON WHATSOEVER, THE ENTIRE LIABILITY OF SEAGATE UNDER ANY PROVISION OF THIS EULA AND YOUR EXCLUSIVE REMEDY HEREUNDER SHALL BE LIMITED TO, AND IN NO EVENT WILL SEAGATE'S TOTAL CUMULATIVE DAMAGES EXCEED, THE FEES PAID BY THE LICENSEE TO SEAGATE FOR THE PRODUCT. ADDITIONALLY, IN NO EVENT SHALL SEAGATE'S LICENSORS OR SUPPLIERS BE LIABLE FOR ANY DAMAGES OF ANY KIND.

8. Privacy. Seagate’s collection, use and disclosure of personally identifiable information in connection

with your use of the Product is governed by Seagate's Privacy Policy which is located at <http://www.seagate.com/legal-privacy/privacy-policy/> As further described in Seagate's Privacy Policy, certain Products may include a Product dashboard which allows users to manage Product settings, including but not limited to use of anonymous statistical usage data in connection with personally identifiable information. You agree to Seagate's collection, use, and disclosure of your data in accordance with the Product dashboard settings selected by you for the Product, or in the case of transfer as described in Section 11, you agree to the settings selected by the prior licensee unless or until you make changes to the settings.

9. Indemnification. By accepting the EULA, you agree to indemnify and otherwise hold harmless Seagate, its officers, employees, agents, subsidiaries, affiliates, and other partners from any direct, indirect, incidental, special, consequential or exemplary damages arising out of, relating to, or resulting from your use of the Product or any other matter relating to the Product, including, without limitation, use of any of the Third Party Services.

10. International Trade Compliance. The Software and any related technical data made available for download under this EULA are subject to the customs and export control laws and regulations of the United States ("U.S.") and may also be subject to the customs and export laws and regulations of the country in which the download is contemplated. Further, under U.S. law, the Software and any related technical data made available for download under this EULA may not be sold, leased or otherwise transferred to restricted countries, or used by a restricted end-user (as determined on any one of the U.S. government restricted parties lists, found at <http://www.bis.doc.gov/complianceand enforcement/liststocheck.htm>) or an end-user engaged in activities related to weapons of mass destruction including, without limitation, activities related to designing, developing, producing or using nuclear weapons, materials, or facilities, missiles or supporting missile projects, or chemical or biological weapons. You acknowledge that you are not a citizen, national, or resident of, and are not under control of the governments of Cuba, Iran, North Korea, Sudan or Syria; are not otherwise a restricted end-user as defined by U.S. export control laws; and are not engaged in proliferation activities. Further, you acknowledge that you will not download or otherwise export or re-export the Software or any related technical data directly or indirectly to the above-mentioned countries or to citizens, nationals, or residents of those countries, or to any other restricted end user or for any restricted end-use.

11. General. This EULA between Licensee and Seagate is governed by and construed in accordance with the laws of the State of California without regard to conflict of laws principles. The EULA constitutes the entire agreement between Seagate and you relating to the Product and governs your use of the Product, superseding any prior agreement between you and Seagate relating to the subject matter hereof. If any provision of this EULA is held by a court of competent jurisdiction to be contrary to law, such provision

will be changed and interpreted so as to best accomplish the objectives of the original provision to the fullest extent allowed by law and the remaining provisions of the EULA will remain in force and effect. The Product and any related technical data are provided with restricted rights. Use, duplication, or disclosure by the U.S. government is subject to the restrictions as set forth in subparagraph (c)(1)(iii) of DFARS 252.227-7013 (The Rights in Technical Data and Computer Product) or subparagraphs (c)(1) and (2) of 48 CFR 52.227-19 (Commercial Computer Product – Restricted Rights), as applicable. The manufacturer is Seagate. You may not transfer or assign this EULA or any rights under this EULA, except that you may make a one-time, permanent transfer of this EULA and the Software to another end user, provided that (i) you do not retain any copies of the Software, the Hardware, the media and printed materials, Upgrades (if any), and this EULA, and (ii) prior to the transfer, the end user receiving this EULA and the Software agrees to all the EULA terms. Any attempted assignment in violation of this Section is void. Seagate, the Seagate logo, and other Seagate names and logos are the trademarks of Seagate.

5.4.2016

GNU LESSER GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

Copyright © 2007 Free Software Foundation, Inc. <<http://fsf.org/>>

Everyone is permitted to copy and distribute verbatim copies of this license document, but changing it is not allowed.

This version of the GNU Lesser General Public License incorporates the terms and conditions of version 3 of the GNU General Public License, supplemented by the additional permissions listed below.

0. Additional Definitions.

As used herein, “this License” refers to version 3 of the GNU Lesser General Public License, and the “GNU GPL” refers to version 3 of the GNU General Public License.

“The Library” refers to a covered work governed by this License, other than an Application or a Combined Work as defined below.

An “Application” is any work that makes use of an interface provided by the Library, but which is not otherwise based on the Library. Defining a subclass of a class defined by the Library is deemed a mode of using an interface provided by the Library.

A “Combined Work” is a work produced by combining or linking an Application with the Library. The particular version of the Library with which the Combined Work was made is also called the “Linked Version”.

The “Minimal Corresponding Source” for a Combined Work means the Corresponding Source for the Combined Work, excluding any source code for portions of the Combined Work that, considered in isolation, are based on the Application, and not on the Linked Version.

The “Corresponding Application Code” for a Combined Work means the object code and/or source code for the Application, including any data and utility programs needed for reproducing the Combined Work from the Application, but excluding the System Libraries of the Combined Work.

1. Exception to Section 3 of the GNU GPL.

You may convey a covered work under sections 3 and 4 of this License without being bound by section 3 of the GNU GPL.

2. Conveying Modified Versions.

If you modify a copy of the Library, and, in your modifications, a facility refers to a function or data to be supplied by an Application that uses the facility (other than as an argument passed when the facility is invoked), then you may convey a copy of the modified version:

- a) under this License, provided that you make a good faith effort to ensure that, in the event an Application does not supply the function or data, the facility still operates, and performs whatever part of its purpose remains meaningful, or
- b) under the GNU GPL, with none of the additional permissions of this License applicable to that copy.

3. Object Code Incorporating Material from Library Header Files.

The object code form of an Application may incorporate material from a header file that is part of the Library. You may convey such object code under terms of your choice, provided that, if the incorporated material is not limited to numerical parameters, data structure layouts and accessors, or small macros, inline functions and templates (ten or fewer lines in length), you do both of the following:

- a) Give prominent notice with each copy of the object code that the Library is used in it and that the Library and its use are covered by this License.
- b) Accompany the object code with a copy of the GNU GPL and this license document.

4. Combined Works.

You may convey a Combined Work under terms of your choice that, taken together, effectively do not restrict modification of the portions of the Library contained in the Combined Work and reverse engineering for debugging such modifications, if you also do each of the following:

- a) Give prominent notice with each copy of the Combined Work that the Library is used in it and that the Library and its use are covered by this License.
- b) Accompany the Combined Work with a copy of the GNU GPL and this license document.
- c) For a Combined Work that displays copyright notices during execution, include the copyright notice for the Library among these notices, as well as a reference directing the user to the copies of the GNU GPL and this license document.
- d) Do one of the following:
 - 0) Convey the Minimal Corresponding Source under the terms of this License, and the Corresponding Application Code in a form suitable for, and under terms that permit, the user to recombine or relink the Application with a modified version of the Linked Version to produce a modified Combined Work, in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.
 - 1) Use a suitable shared library mechanism for linking with the Library. A suitable mechanism is one that (a) uses at run time a copy of the Library already present on the user's computer system, and (b) will operate properly with a modified version of the Library that is interface-compatible with the Linked Version.
- e) Provide Installation Information, but only if you would otherwise be required to provide such information under section 6 of the GNU GPL, and only to the extent that such information is necessary to install and execute a modified version of the Combined Work produced by recombining or relinking the Application with a modified version of the Linked Version. (If you use option 4d0, the Installation Information must accompany the Minimal Corresponding Source and Corresponding Application Code. If you use option 4d1, you must provide the Installation Information in the manner specified by section 6 of the GNU GPL for conveying Corresponding Source.)

5. Combined Libraries.

You may place library facilities that are a work based on the Library side by side in a single library together with other library facilities that are not Applications and are not covered by this License, and convey such a combined library under terms of your choice, if you do both of the following:

- a) Accompany the combined library with a copy of the same work based on the Library, uncombined with any other library facilities, conveyed under the terms of this License.
- b) Give prominent notice with the combined library that part of it is a work based on the Library, and explaining where to find the accompanying uncombined form of the same work.

6. Revised Versions of the GNU Lesser General Public License.

The Free Software Foundation may publish revised and/or new versions of the GNU Lesser General Public License from time to time. Such new versions will be similar in spirit to the present version, but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library as you received it specifies that a certain numbered version of the GNU Lesser General Public License “or any later version” applies to it, you have the option of following the terms and conditions either of that published version or of any later version published by the Free Software Foundation. If the Library as you received it does not specify a version number of the GNU Lesser General Public License, you may choose any version of the GNU Lesser General Public License ever published by the Free Software Foundation.

If the Library as you received it specifies that a proxy can decide whether future versions of the GNU Lesser General Public License shall apply, that proxy's public statement of acceptance of any version is permanent authorization for you to choose that version for the Library.