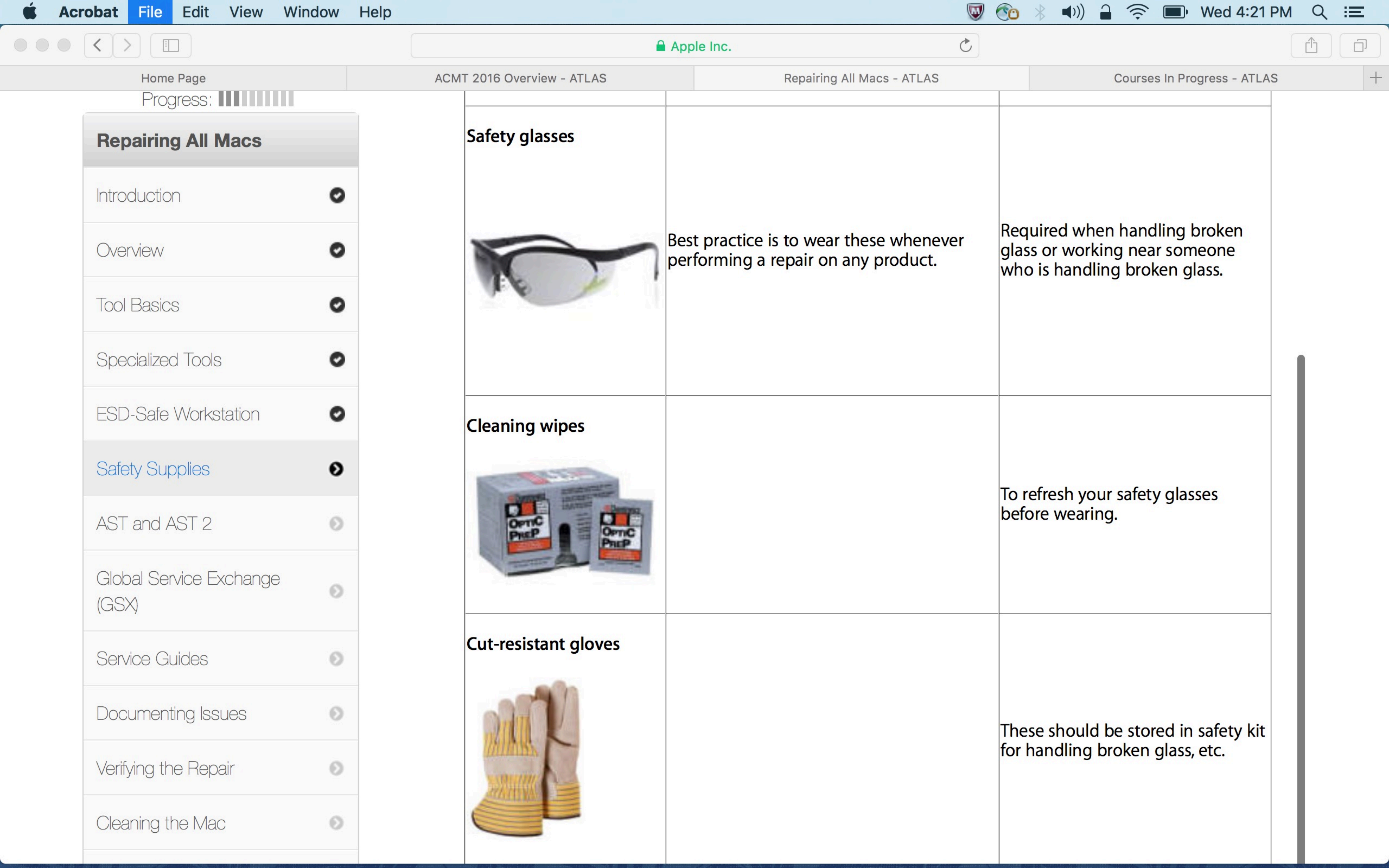
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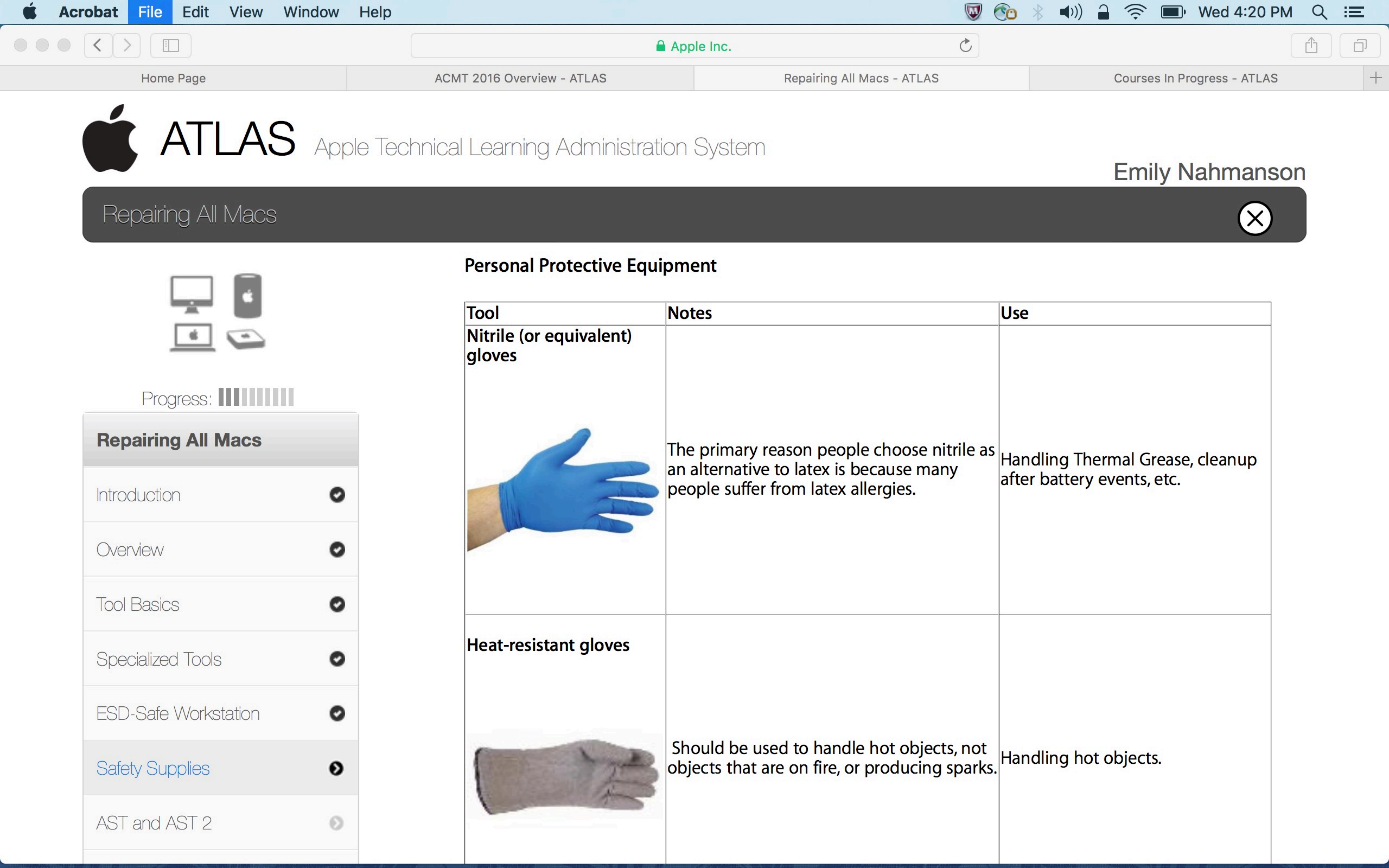
Safety glasses	Best practice is to wear these whenever performing a repair on any product.	Required when handling broken glass or working near someone who is handling broken glass.
Cleaning wipes		To refresh your safety glasses before wearing.
Cut-resistant gloves		These should be stored in safety kit for handling broken glass, etc.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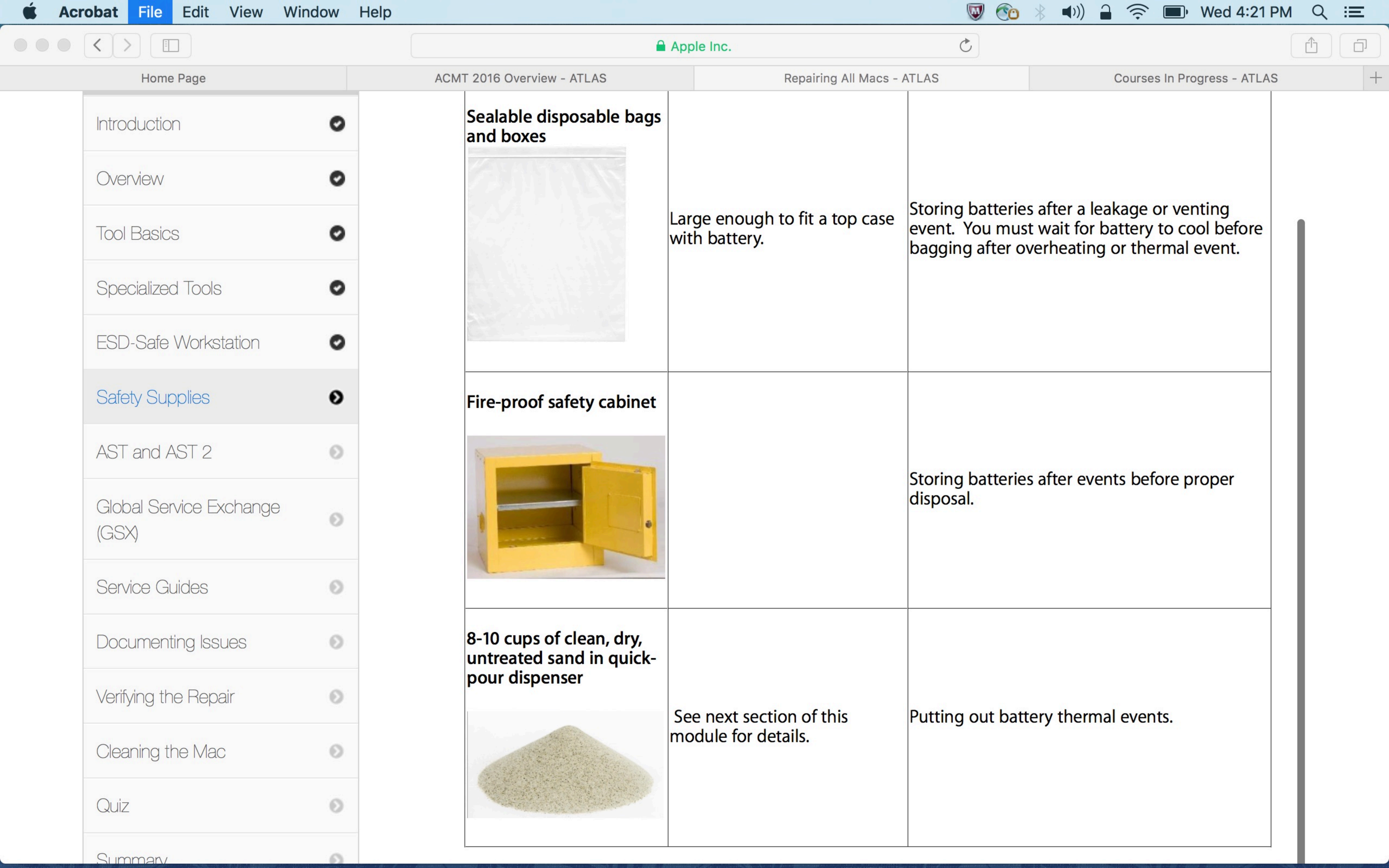
Personal Protective Equipment

Tool	Notes	Use
Nitrile (or equivalent) gloves	The primary reason people choose nitrile as an alternative to latex is because many people suffer from latex allergies.	Handling Thermal Grease, cleanup after battery events, etc.
Heat-resistant gloves	Should be used to handle hot objects, not objects that are on fire, or producing sparks.	Handling hot objects.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Summary

Sealable disposable bags and boxes	Large enough to fit a top case with battery.	Storing batteries after a leakage or venting event. You must wait for battery to cool before bagging after overheating or thermal event.
Fire-proof safety cabinet		Storing batteries after events before proper disposal.
8-10 cups of clean, dry, untreated sand in quick-pour dispenser	See next section of this module for details.	Putting out battery thermal events.

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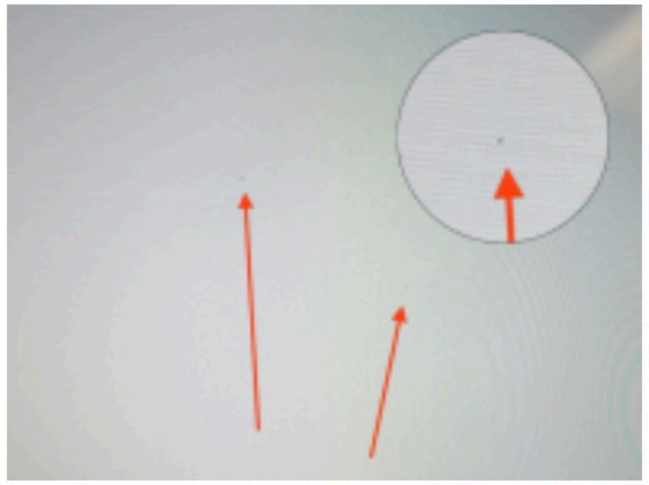
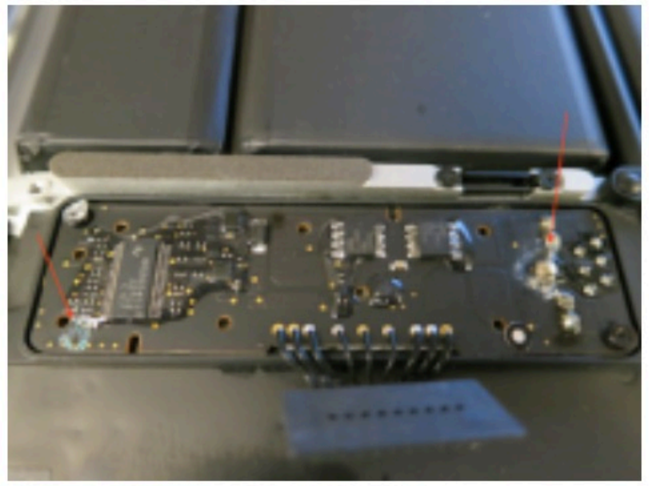
Visual Mechanical Inspection Guides

The Visual/Mechanical Inspection (VMI) will help you to determine whether a user's described issue was caused by a defect in materials and workmanship or by accidental damage, and to use that information to determine which service type to use. Defects in materials and workmanship are eligible for service under Apple's Limited Warranty or applicable consumer law. Some forms of damage may be eligible for service under an AppleCare Protection Plan (APP) or for out-of-warranty service at a cost to the user.

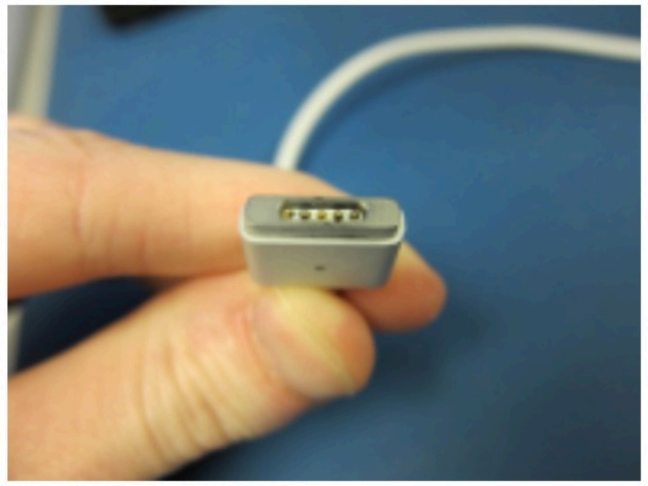
For Mac Portables the following subject areas are currently covered:



Display Clamshells



Liquid Damage



Power Adapters

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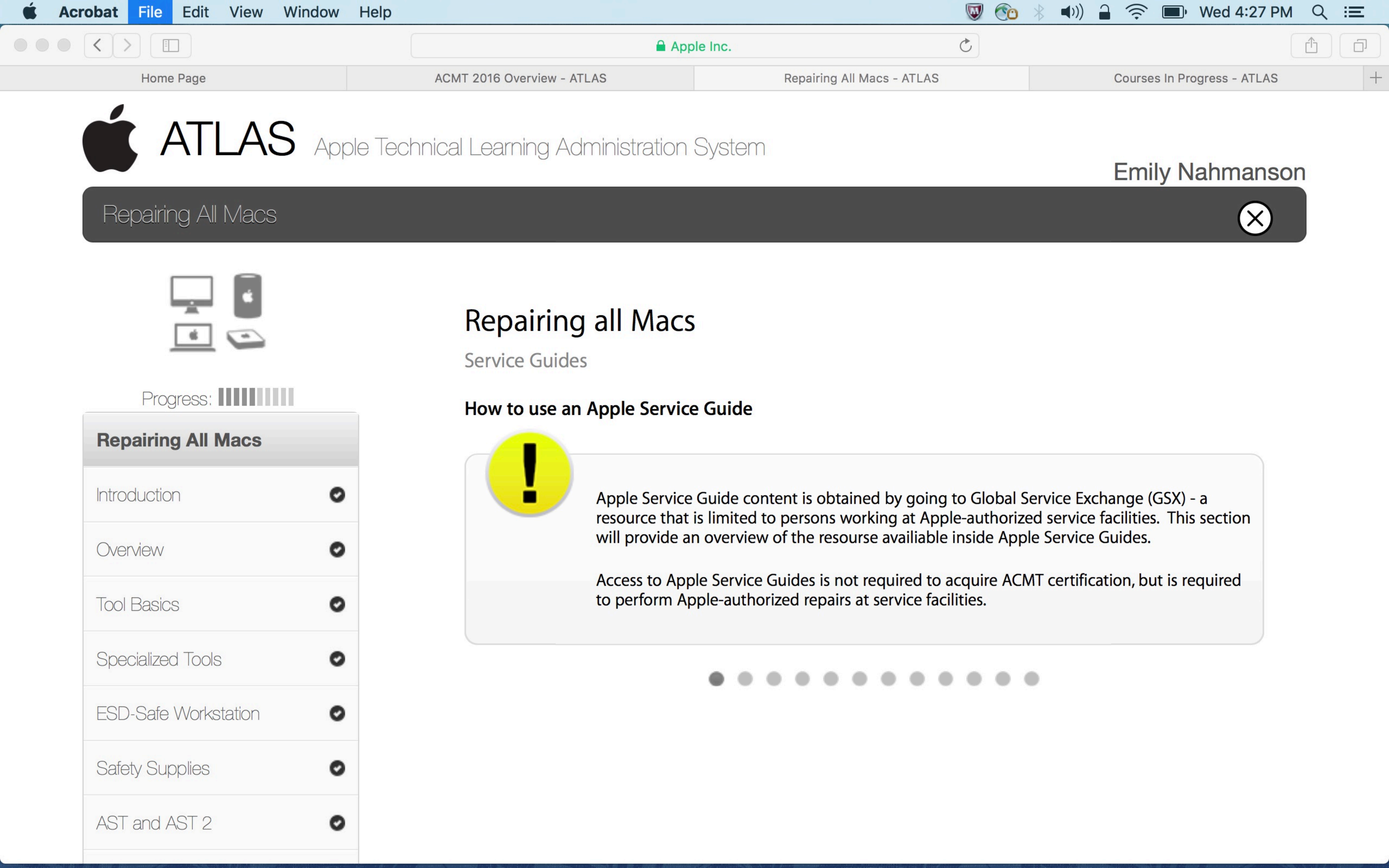
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Service Guides

How to use an Apple Service Guide

Apple Service Guide content is obtained by going to Global Service Exchange (GSX) - a resource that is limited to persons working at Apple-authorized service facilities. This section will provide an overview of the resourse availiable inside Apple Service Guides.

Access to Apple Service Guides is not required to acquire ACMT certification, but is required to perform Apple-authorized repairs at service facilities.

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Global Service Exchange (GSX)

Access to Global Service Exchange

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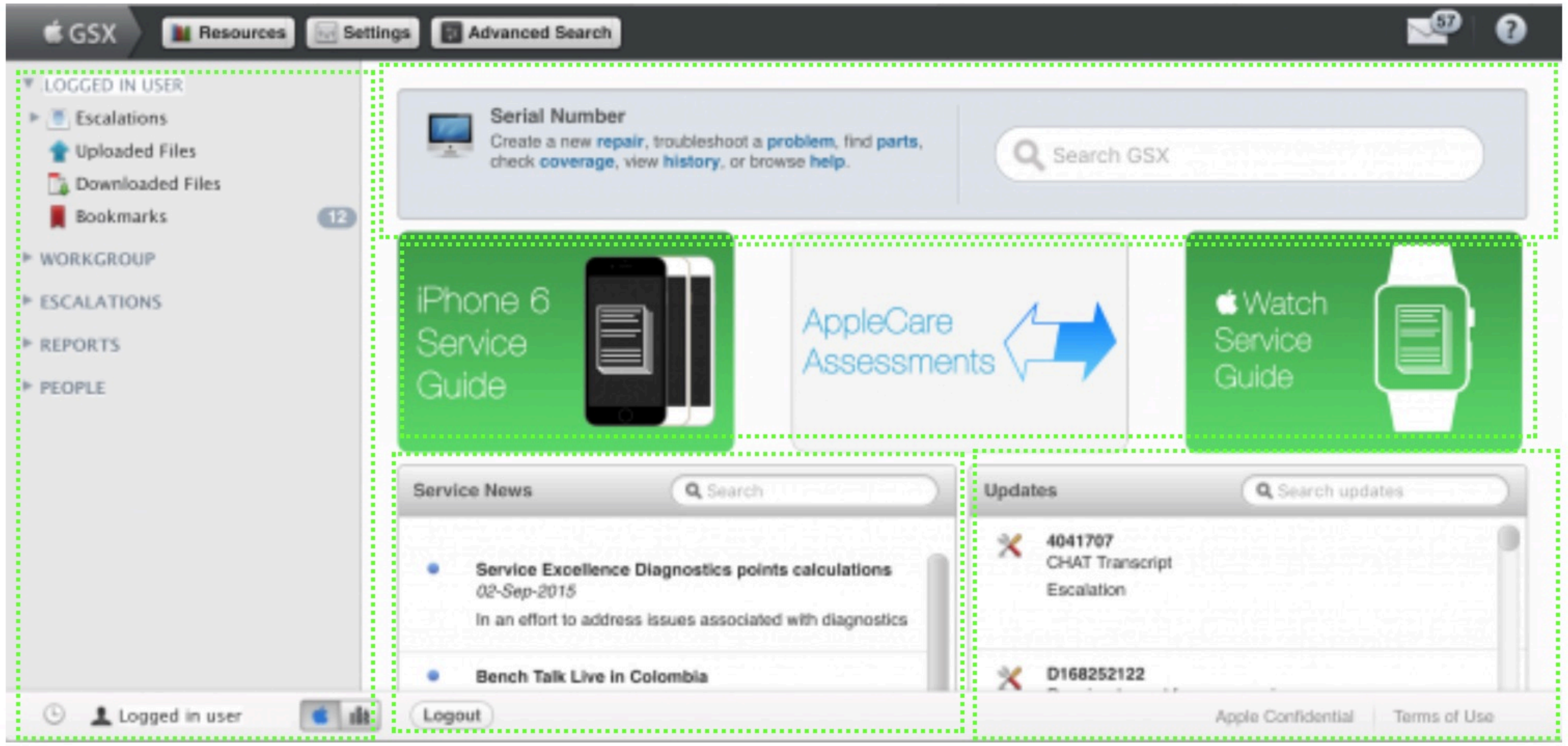
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Downloaded Files
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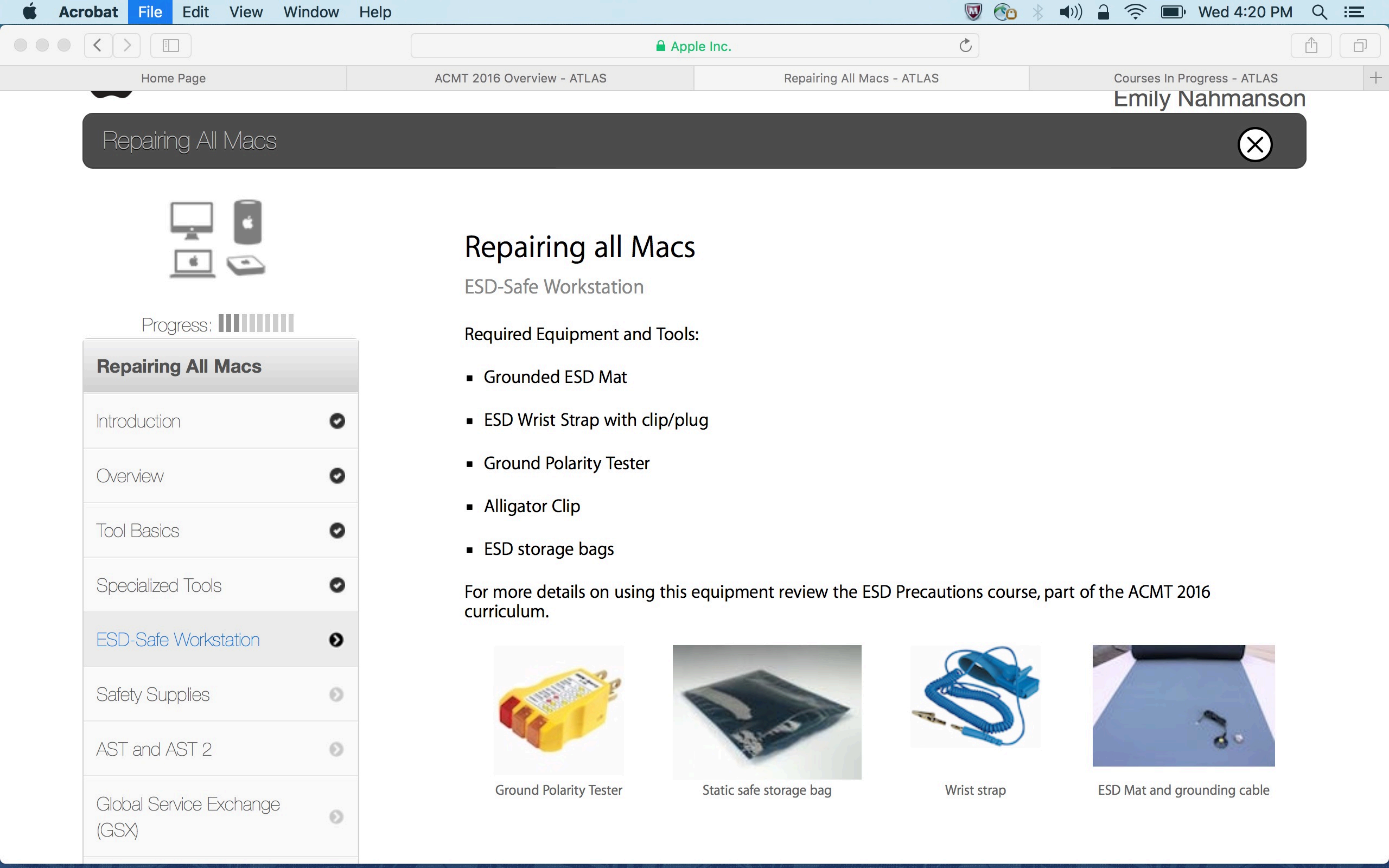
WORKGROUP
ESCALATIONS
REPORTS
PEOPLE
Search GSX
iPhone 6 Service Guide
AppleCare Assessments
Watch Service Guide
Search
Search updates
Logged in user
Logout
Apple Confidential
Terms of Use

Serial Number
Create a new repair, troubleshoot a problem, find parts, check coverage, view history, or browse help.

Service News
- **Service Excellence Diagnostics points calculations**
  02-Sep-2015
  In an effort to address issues associated with diagnostics
- **Bench Talk Live in Colombia**

Updates
4041707
CHAT Transcript
Escalation

D168252122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ESD-Safe Workstation

Required Equipment and Tools:

- Grounded ESD Mat
- ESD Wrist Strap with clip/plug
- Ground Polarity Tester
- Alligator Clip
- ESD storage bags

For more details on using this equipment review the ESD Precautions course, part of the ACMT 2016 curriculum.

Ground Polarity Tester

Static safe storage bag

Wrist strap

ESD Mat and grounding cable

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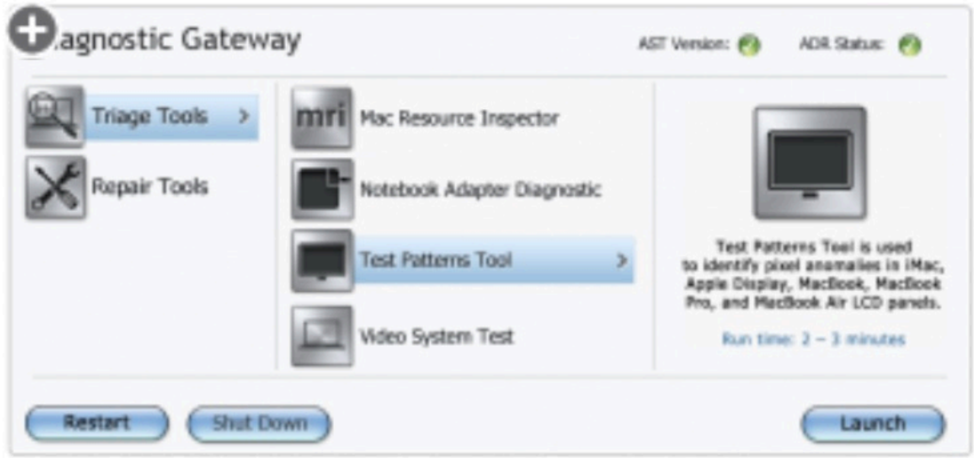
AST and AST 2

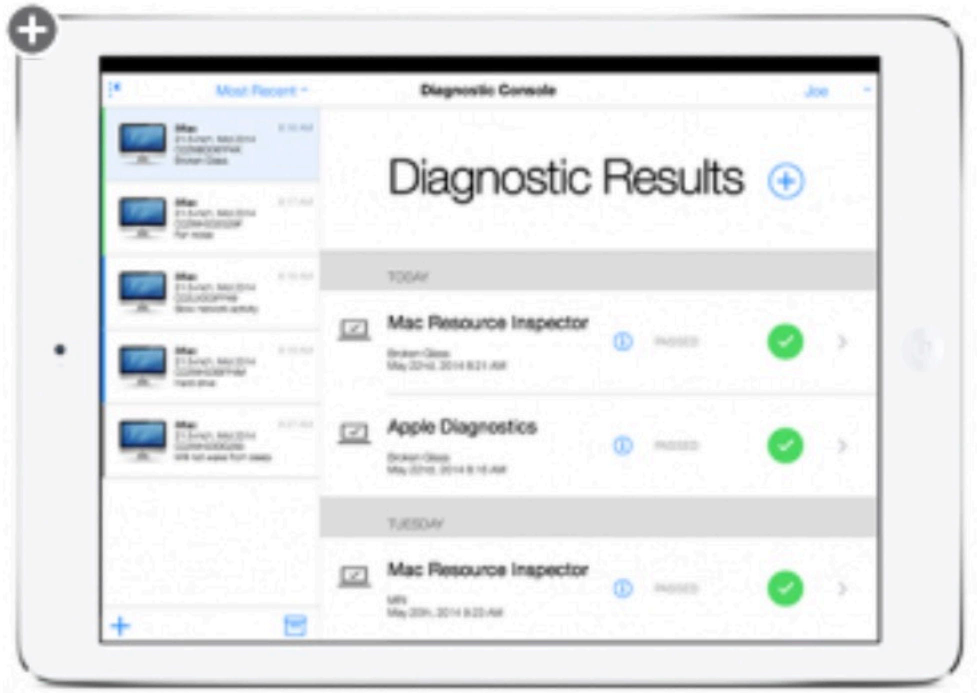
During the life cycle of a repair it is necessary to run diagnositics.


agnostic Gateway
AST Version:
ADR Status:
Triage Tools
Repair Tools
Mac Resource Inspector
Notebook Adapter Diagnostic
Test Patterns Tool
Video System Test
Restart
Shut Down
Launch

Test Patterns Tool is used to identify pixel anomalies in iMac, Apple Display, MacBook, MacBook Pro, and MacBook Air LCD panels.

Run time: 2 – 3 minutes

AST


Most Recent
Diagnostic Console
Diagnostic Results
TODAY
Mac Resource Inspector
Apple Diagnostics
TUESDAY
Mac Resource Inspector

AST 2

AST (Apple Service Toolkit) and AST 2 (Apple Service Toolkit 2) are diagnostic suites provided by Apple to Apple-authorized service facilities.

Both versions of AST are customer-facing diagnostic tools. Tests found within Apple Service Toolkit (1 & 2) can be run in the customer's presence.

Included are individual diagnostics for specific issues, calibration utilities and full system diagnostics like Apple Service Diagnostic.

For more information on using AST and AST 2 see the Diagnostics course, part of the ACMT 2016 curriculum.

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AST and AST 2

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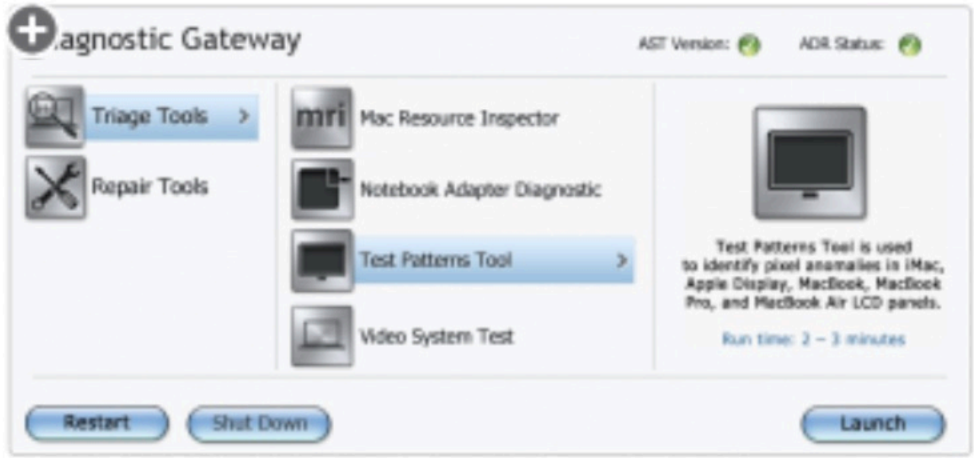
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Mac Resource Inspector
Notebook Adapter Diagnostic
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Video System Test
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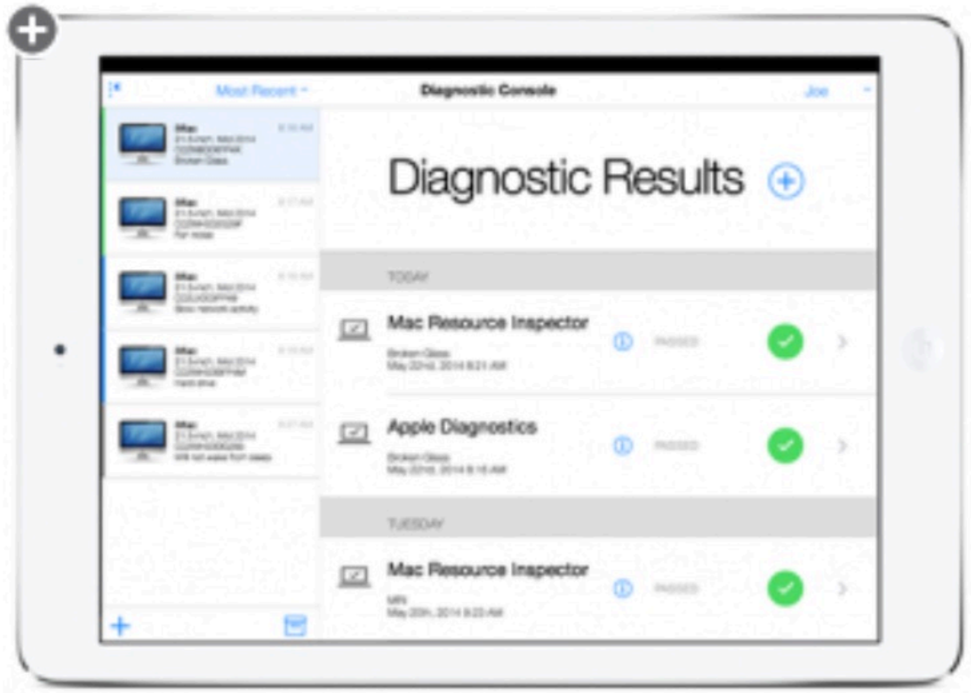
Run time: 2 – 3 minutes
Restart
Shut Down
Launch

AST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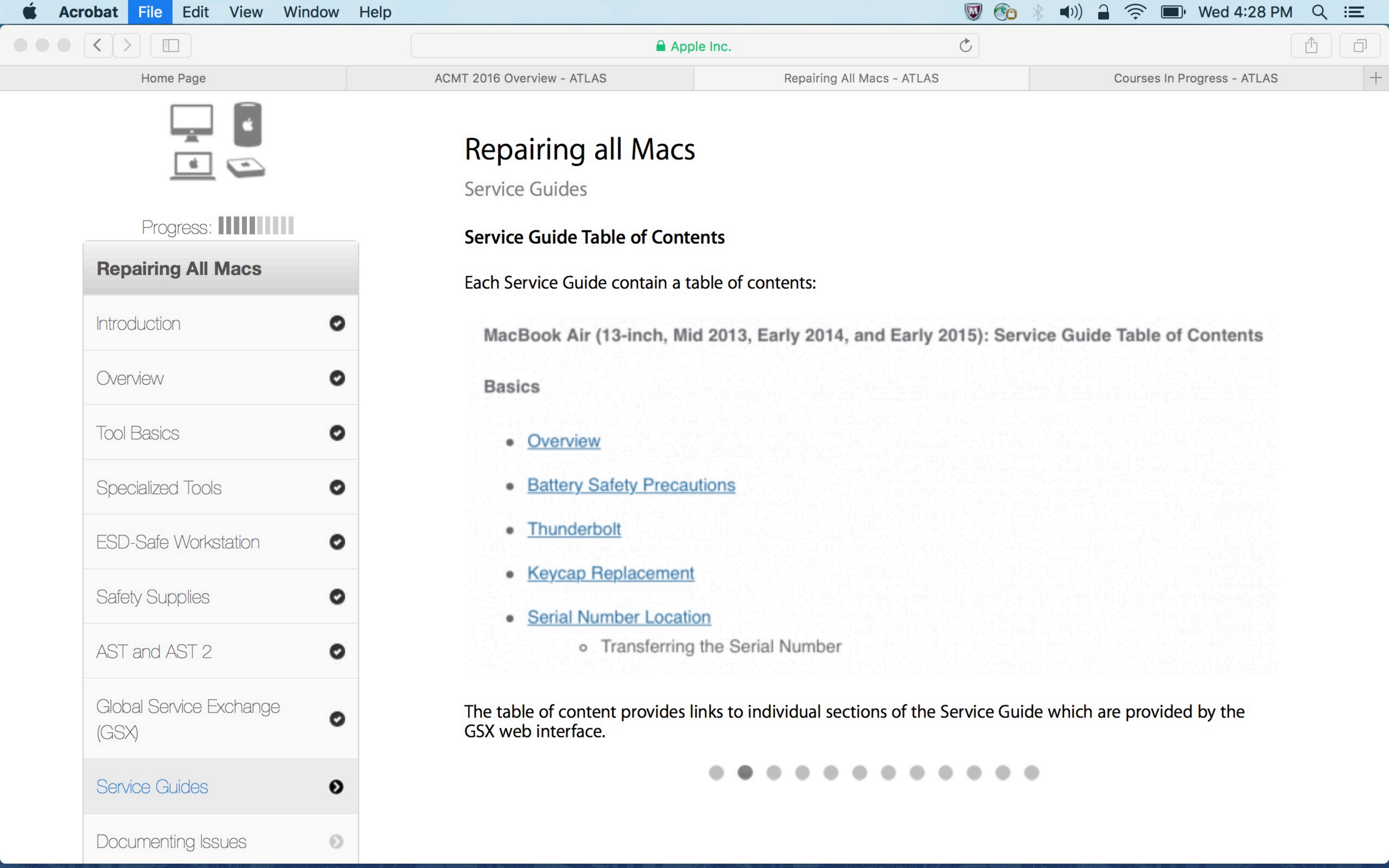
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Service Guides

Service Guide Table of Contents

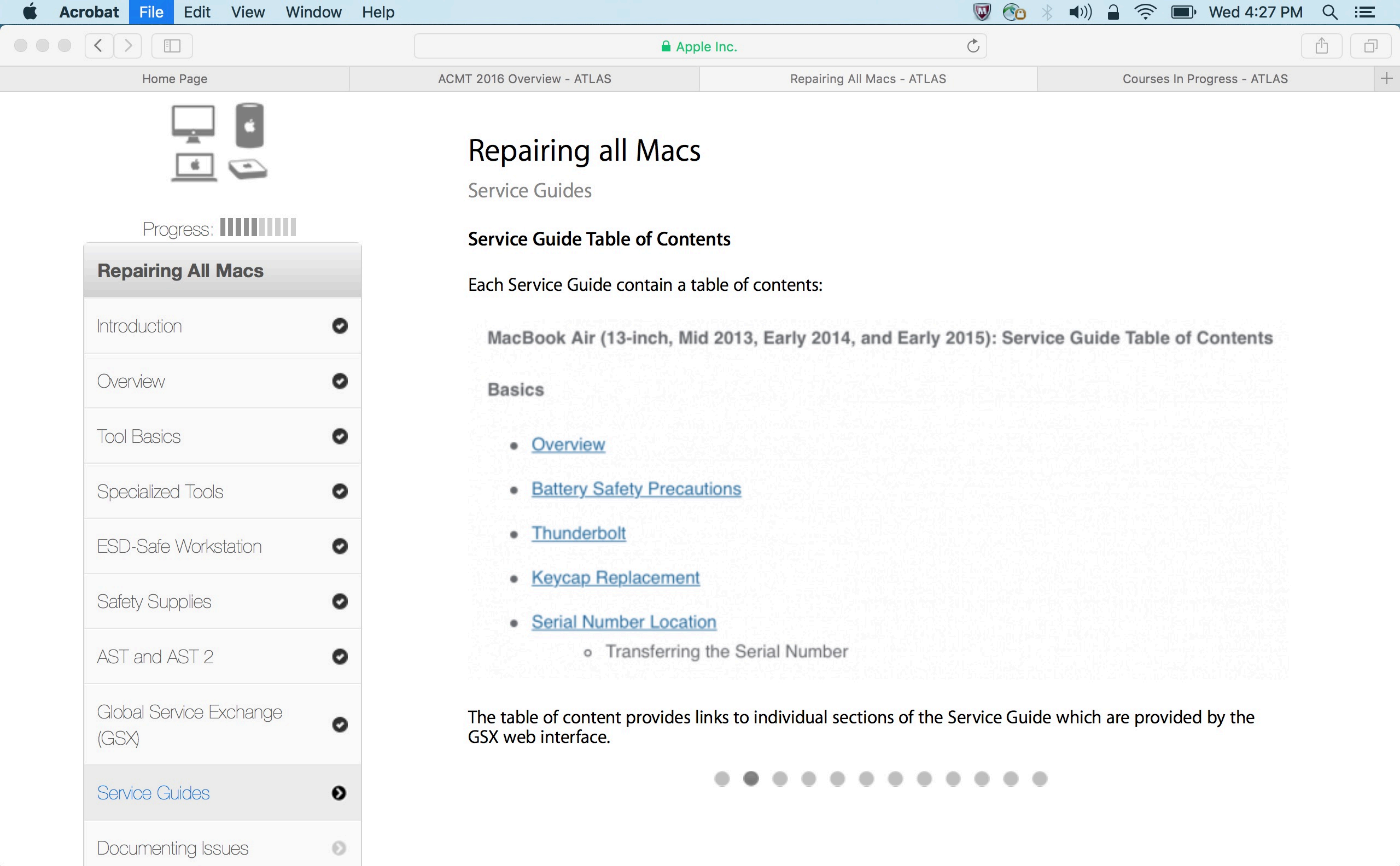
Each Service Guide contain a table of contents:

MacBook Air (13-inch, Mid 2013, Early 2014, and Early 2015): Service Guide Table of Contents

Basics

- Overview
- Battery Safety Precautions
- Thunderbolt
- Keycap Replacement
- Serial Number Location
    - Transferring the Serial Number

The table of content provides links to individual sections of the Service Guide which are provided by the GSX web interface.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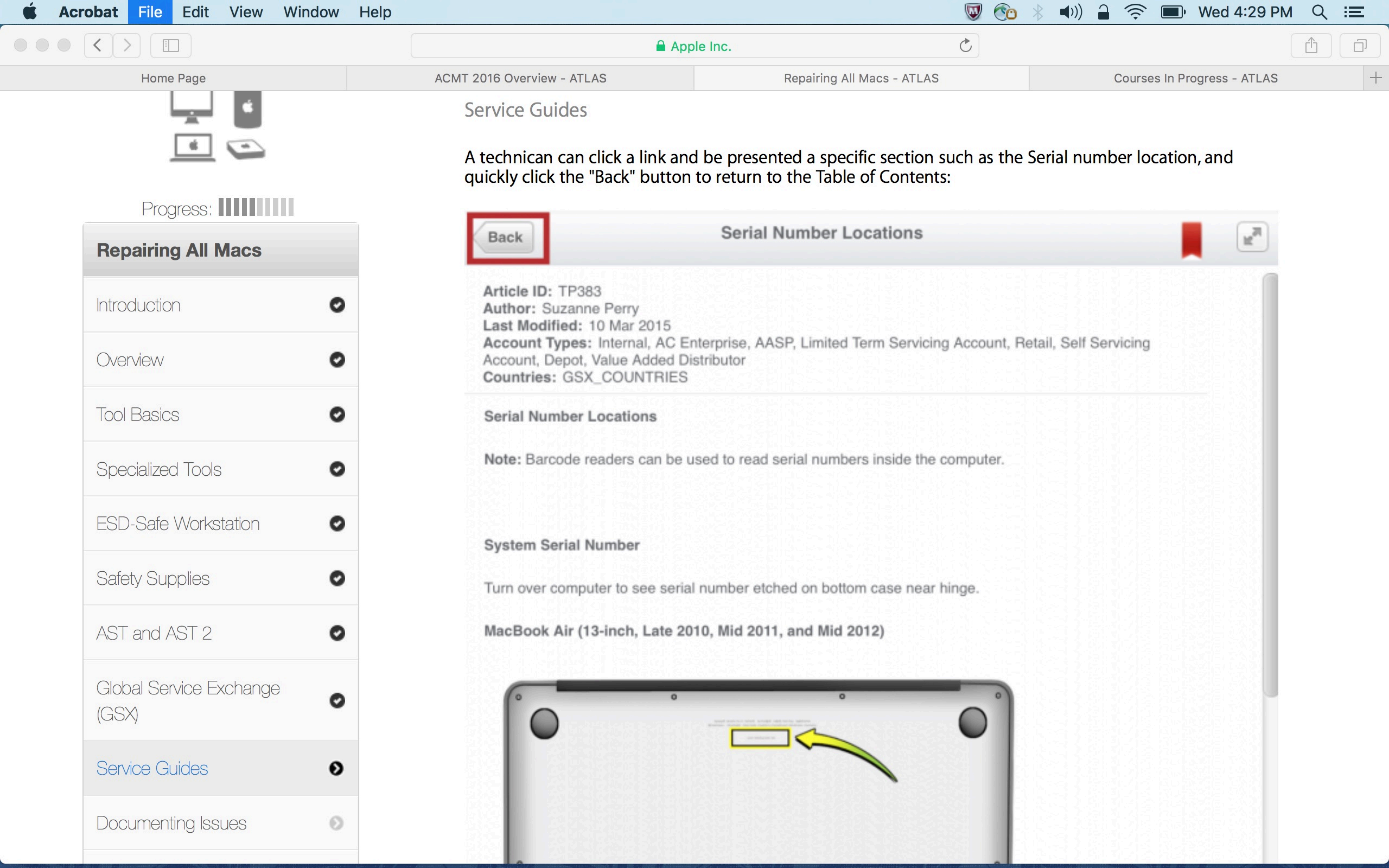
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Service Guides

A technican can click a link and be presented a specific section such as the Serial number location, and quickly click the "Back" button to return to the Table of Contents:

Serial Number Locations

Article ID: TP383
Author: Suzanne Perry
Last Modified: 10 Mar 2015
Account Types: Internal, AC Enterprise, AASP, Limited Term Servicing Account, Retail, Self Servicing Account, Depot, Value Added Distributor
Countries: GSX_COUNTRIES

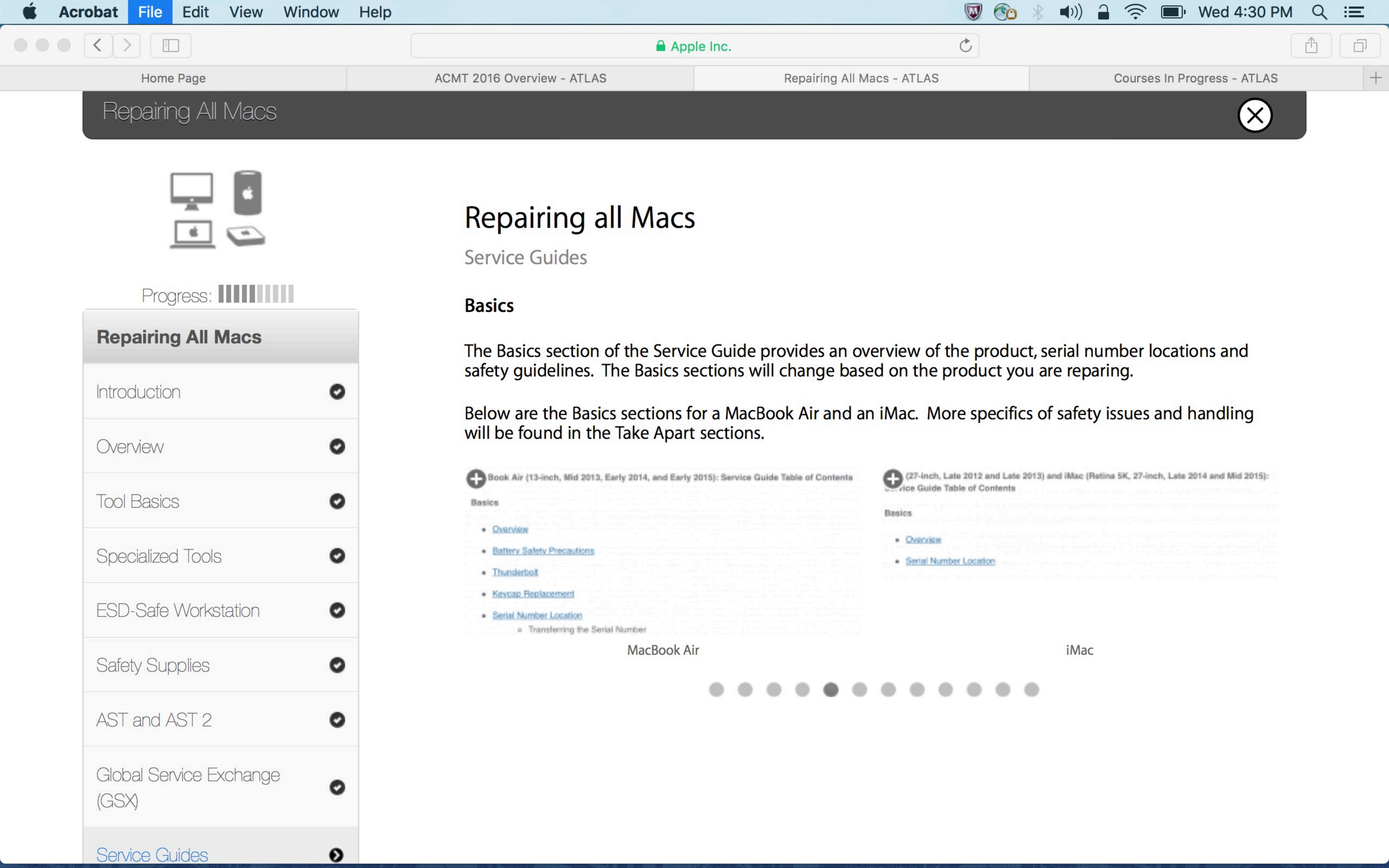
Serial Number Locations

Note: Barcode readers can be used to read serial numbers inside the computer.

System Serial Number

Turn over computer to see serial number etched on bottom case near hinge.

MacBook Air (13-inch, Late 2010, Mid 2011, and Mid 2012)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Basics

The Basics section of the Service Guide provides an overview of the product, serial number locations and safety guidelines. The Basics sections will change based on the product you are reparing.

Below are the Basics sections for a MacBook Air and an iMac. More specifics of safety issues and handling will be found in the Take Apart sections.

Book Air (13-inch, Mid 2013, Early 2014, and Early 2015): Service Guide Table of Contents

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- Thunderbolt
- Keycap Replacement
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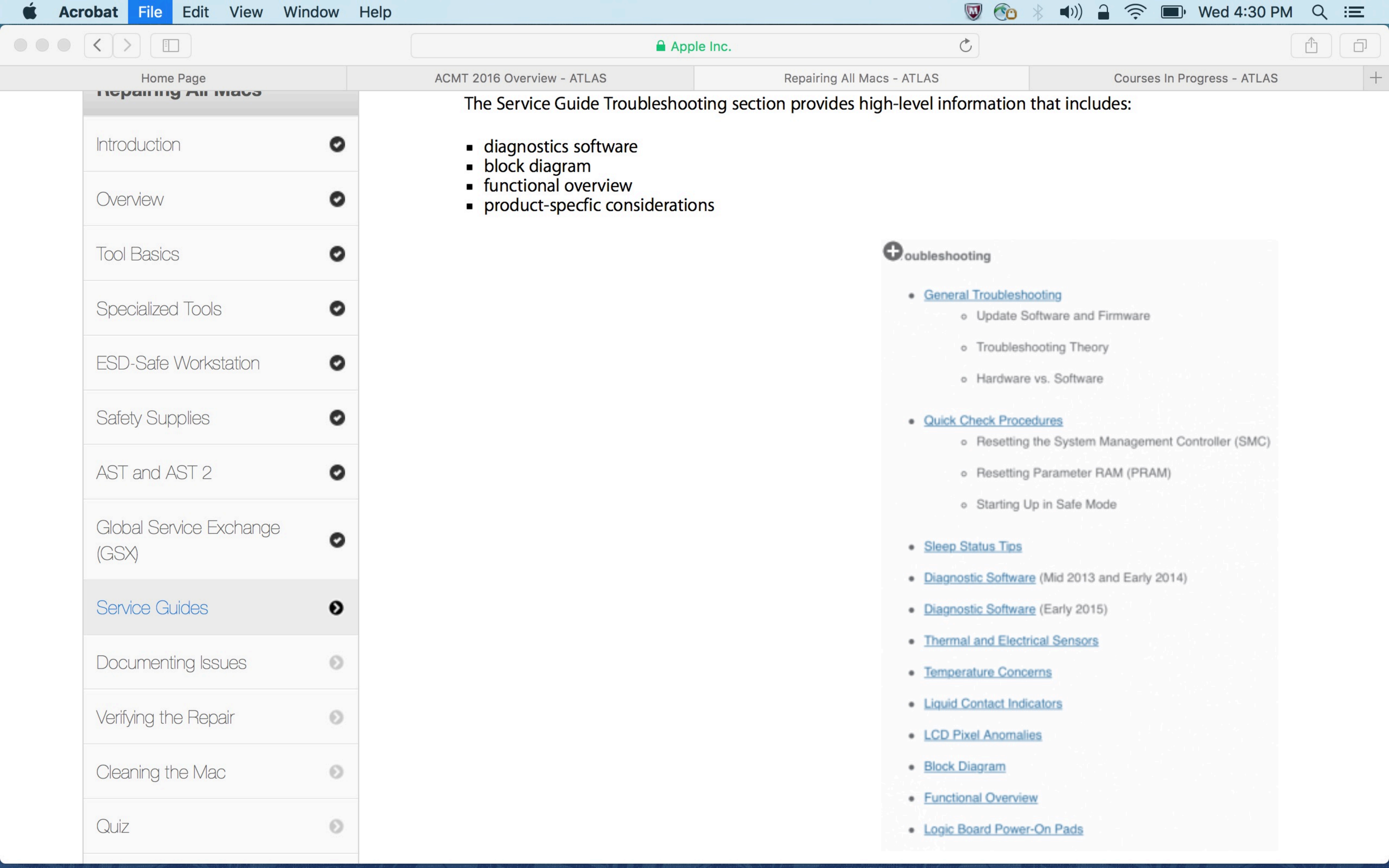
MacBook Air

(27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014 and Mid 2015): vice Guide Table of Contents

Basics

- Overview
- Serial Number Location

iMac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The Service Guide Troubleshooting section provides high-level information that includes:

- diagnostics software
- block diagram
- functional overview
- product-specfic considerations

oubleshooting

- General Troubleshooting
  - Update Software and Firmware
  - Troubleshooting Theory
  - Hardware vs. Software
- Quick Check Procedures
  - Resetting the System Management Controller (SMC)
  - Resetting Parameter RAM (PRAM)
  - Starting Up in Safe Mode
- Sleep Status Tips
- Diagnostic Software (Mid 2013 and Early 2014)
- Diagnostic Software (Early 2015)
- Thermal and Electrical Sensors
- Temperature Concerns
- Liquid Contact Indicators
- LCD Pixel Anomalies
- Block Diagram
- Functional Overview
- Logic Board Power-On Pads

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Quick Check

Quick Checks are things you do before proceeding with any invasive troubleshooting. These procedures can be done quickly and run a very low risk of creating new issues.

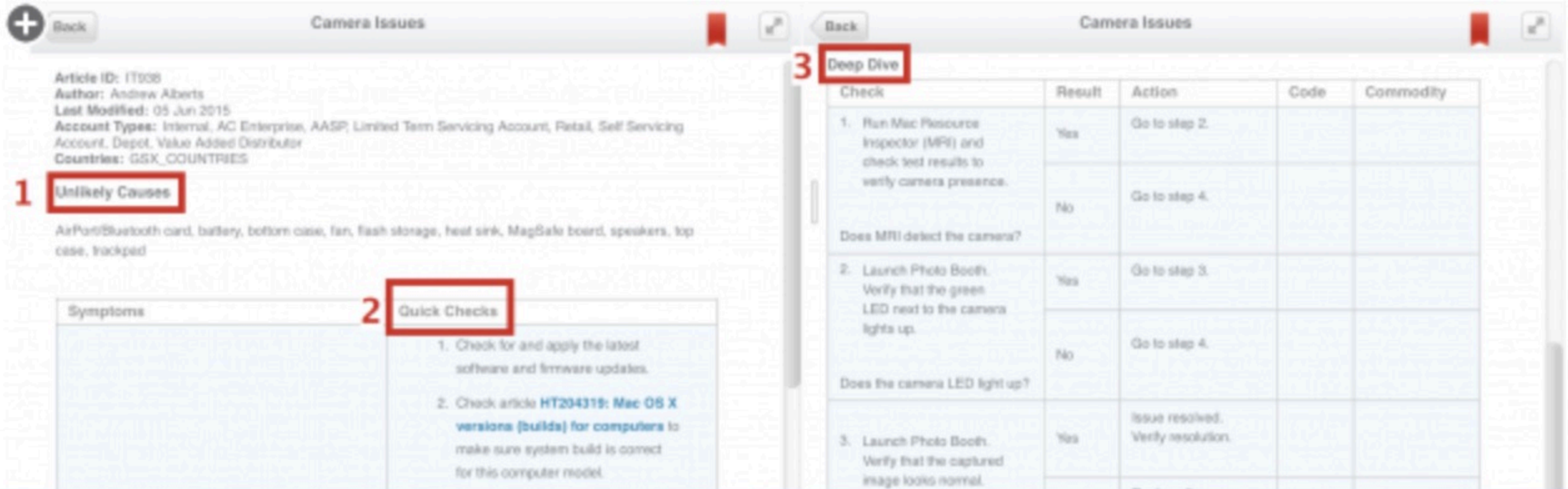
A Quick Check is not necessarily the solution to the issue, but because the tasks are easy to perform and involve little time or expense, these checks are work trying. In some cases, a Quick Check can fix the issue.

Each symptom chart has a quick check section to guide you through the process.

Symptom Charts

Each symptom chart follows a progression:

1. Isolate unlikely causes.
2. Apply Quick Checks.
3. Follow the Deep Dive flow charts.



Article ID: IT938
Author: Andrew Alberts
Last Modified: 05 Jun 2015
Account Types: Internal, AC Enterprise, AASP, Limited Term Servicing Account, Retail, Self Servicing Account, Depot, Value Added Distributor
Countries: GSX_COUNTRIES

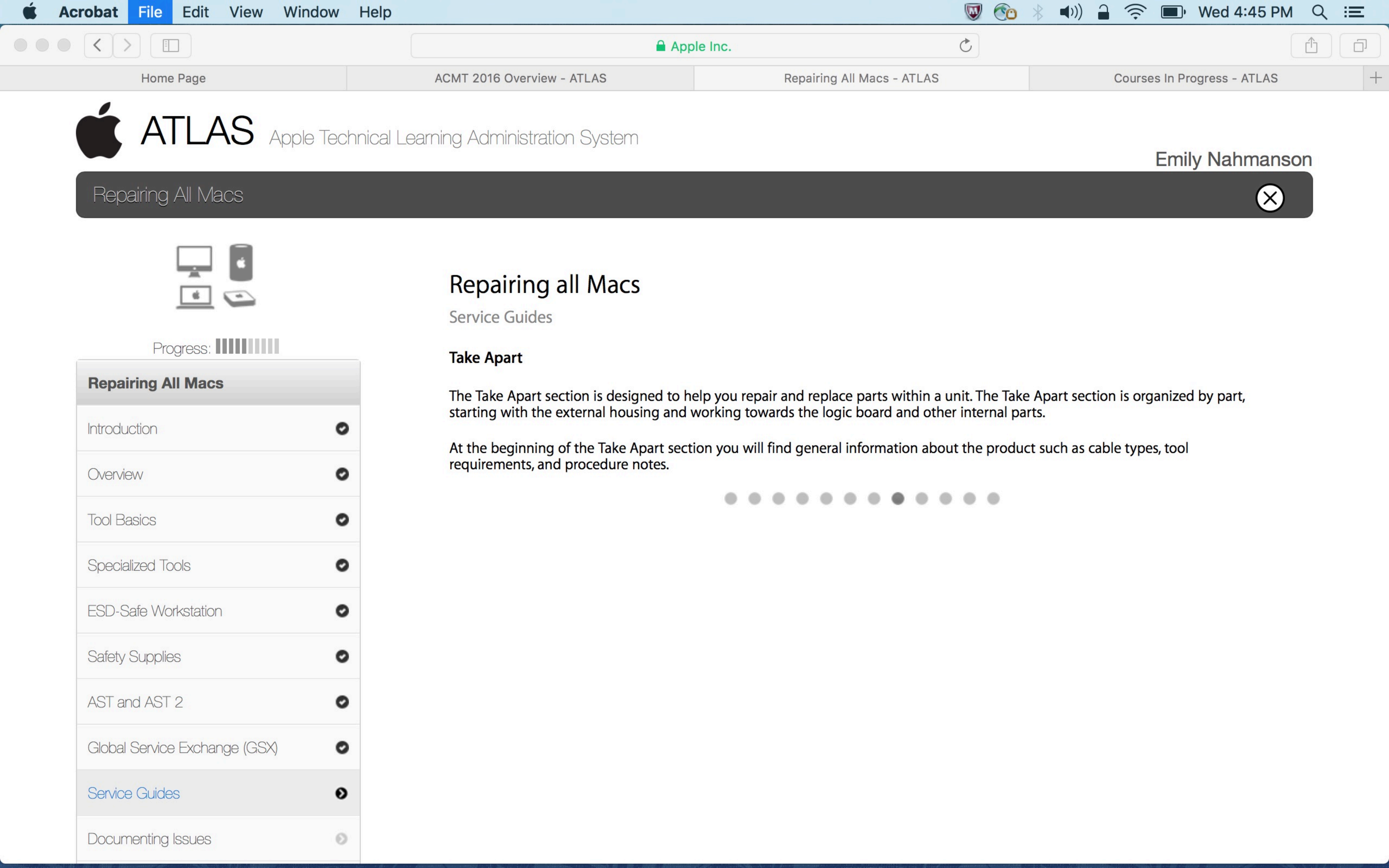
1 **Unlikely Causes**

AirPort/Bluetooth card, battery, bottom case, fan, flash storage, heat sink, MagSafe board, speakers, top case, trackpad

Symptoms	2 Quick Checks
	1. Check for and apply the latest software and firmware updates. 2. Check article **HT204319: Mac OS X versions (builds) for computers** to make sure system build is correct for this computer model.

3 **Deep Dive**

Check	Result	Action	Code	Commodity
1. Run Mac Resource Inspector (MRI) and check test results to verify camera presence. Does MRI detect the camera?	Yes	Go to step 2.		
	No	Go to step 4.		
2. Launch Photo Booth. Verify that the green LED next to the camera lights up. Does the camera LED light up?	Yes	Go to step 3.		
	No	Go to step 4.		
3. Launch Photo Booth. Verify that the captured image looks normal.	Yes	Issue resolved. Verify resolution.		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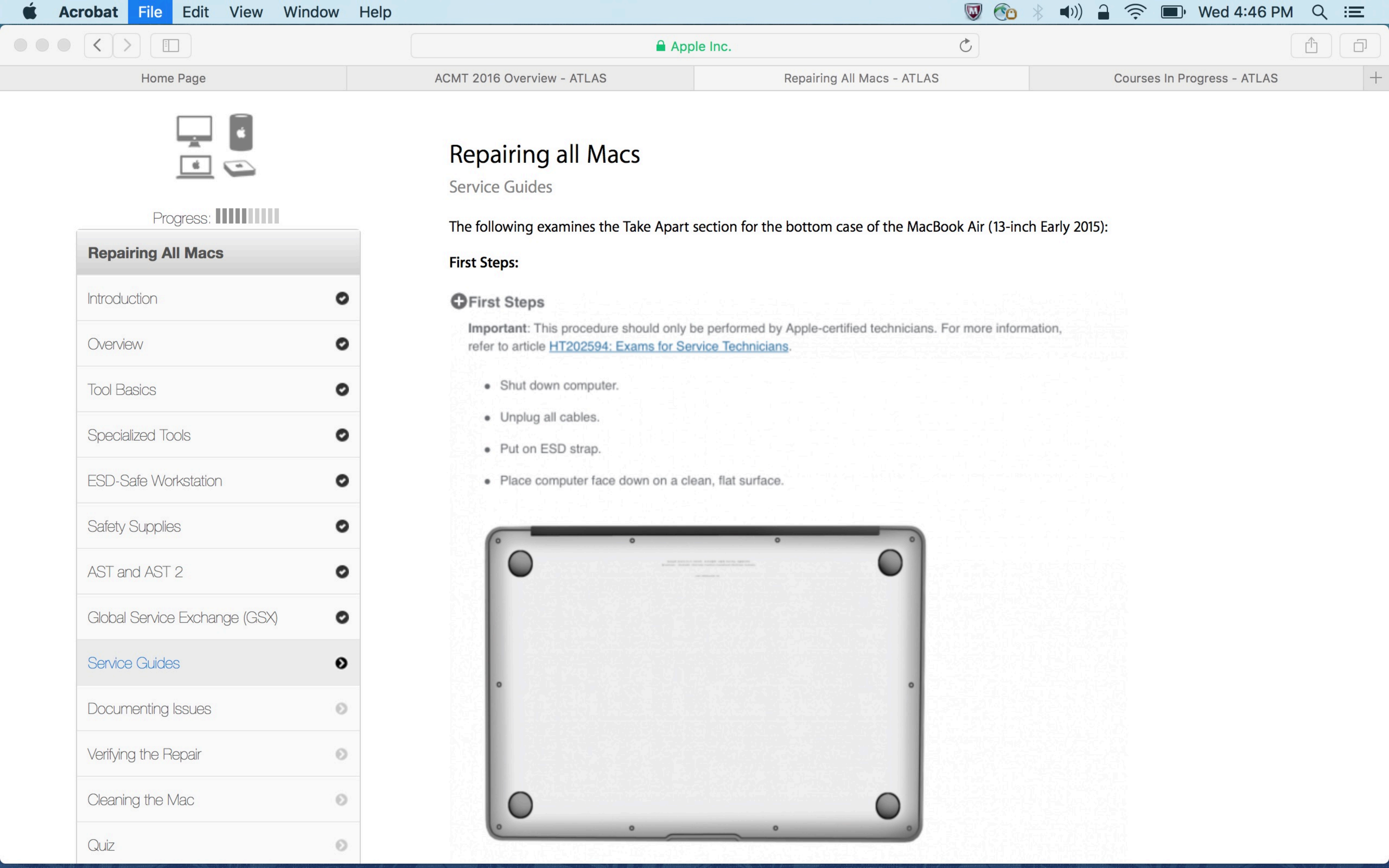
Take Apart

The Take Apart section is designed to help you repair and replace parts within a unit. The Take Apart section is organized by part, starting with the external housing and working towards the logic board and other internal parts.

At the beginning of the Take Apart section you will find general information about the product such as cable types, tool requirements, and procedure notes.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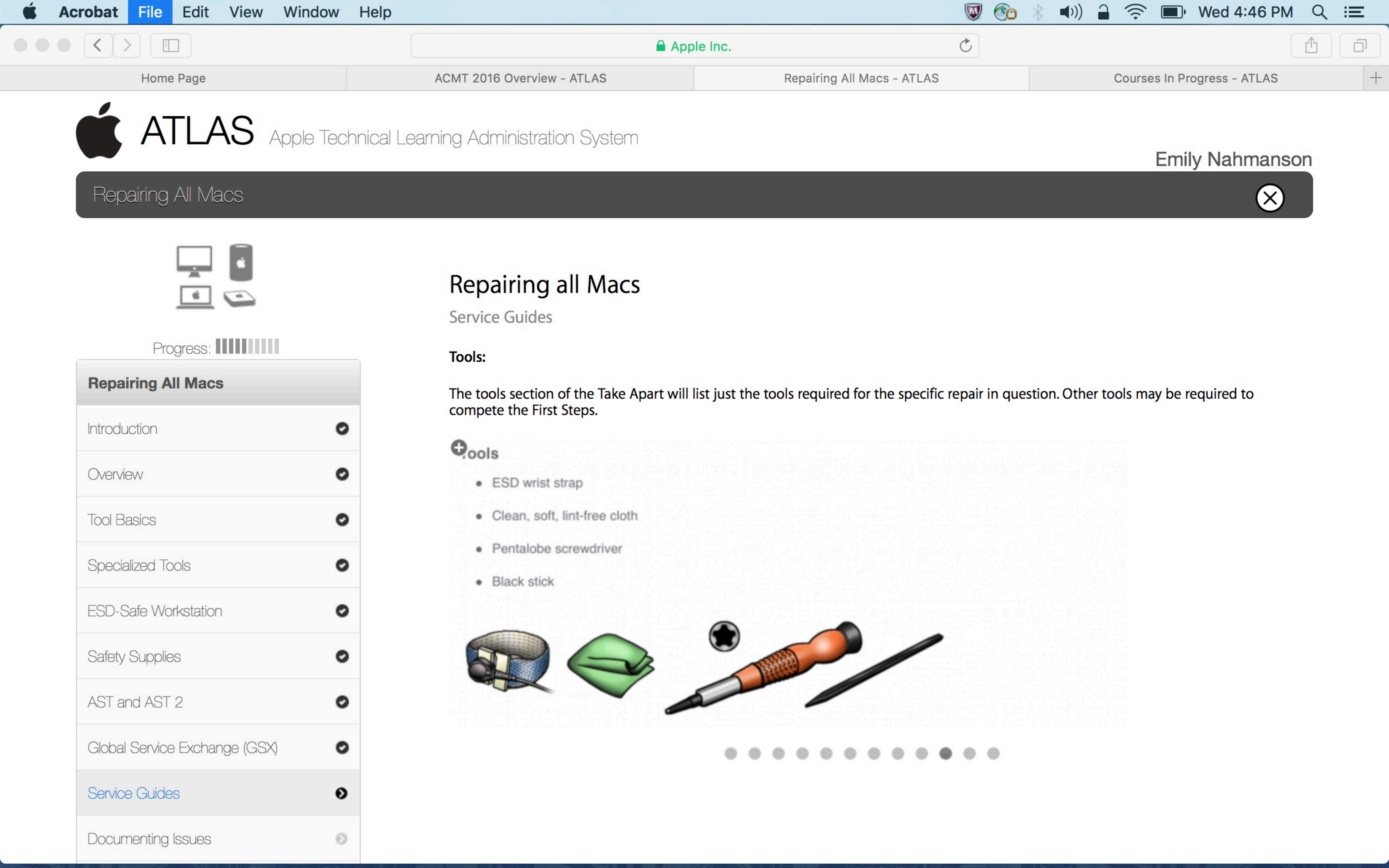
The following examines the Take Apart section for the bottom case of the MacBook Air (13-inch Early 2015):

First Steps:

⊕First Steps

Important: This procedure should only be performed by Apple-certified technicians. For more information, refer to article HT202594: Exams for Service Technicians.

- Shut down computer.
- Unplug all cables.
- Put on ESD strap.
- Place computer face down on a clean, flat surface.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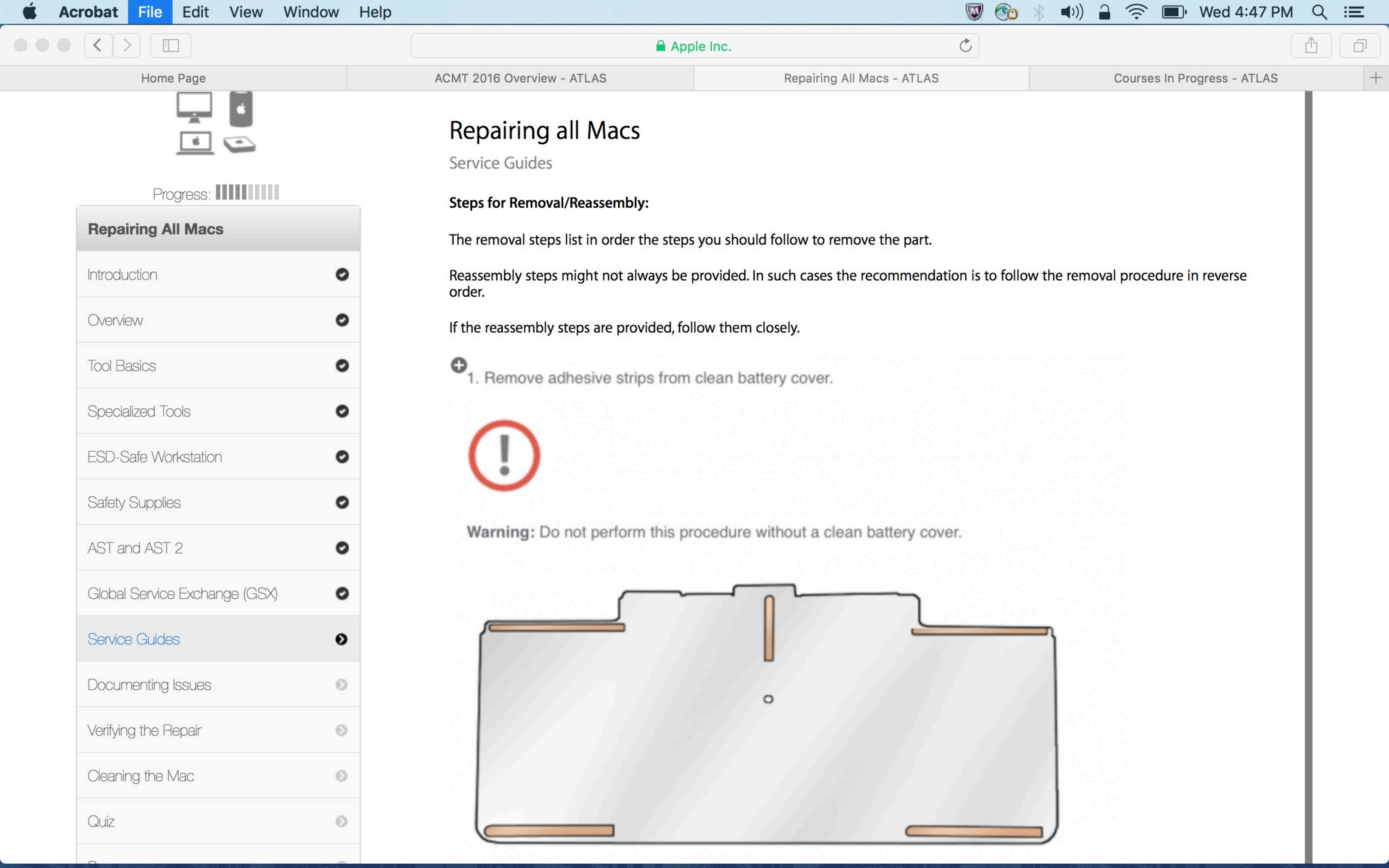
Tools:

The tools section of the Take Apart will list just the tools required for the specific repair in question. Other tools may be required to compete the First Steps.

Tools

- ESD wrist strap
- Clean, soft, lint-free cloth
- Pentalobe screwdriver
- Black stick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Steps for Removal/Reassembly:

The removal steps list in order the steps you should follow to remove the part.

Reassembly steps might not always be provided. In such cases the recommendation is to follow the removal procedure in reverse order.

If the reassembly steps are provided, follow them closely.

1. Remove adhesive strips from clean battery cover.

Warning: Do not perform this procedure without a clean battery cover.

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Emily Nahmanson

Repairing All Macs

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- Tool Basics
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- Safety Supplies
- AST and AST 2
- Global Service Exchange (GSX)
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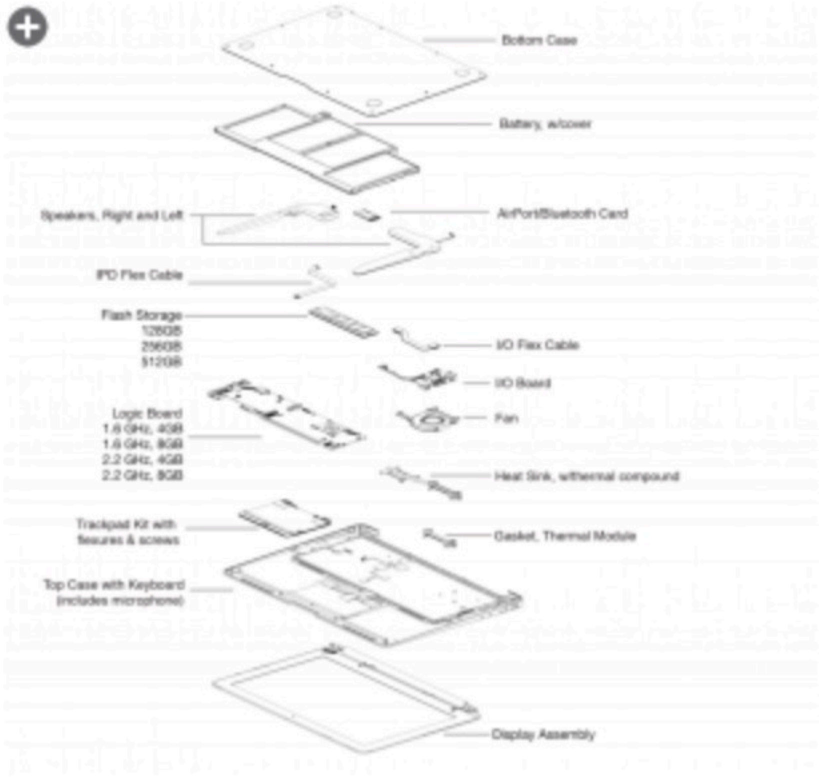
Repairing all Macs

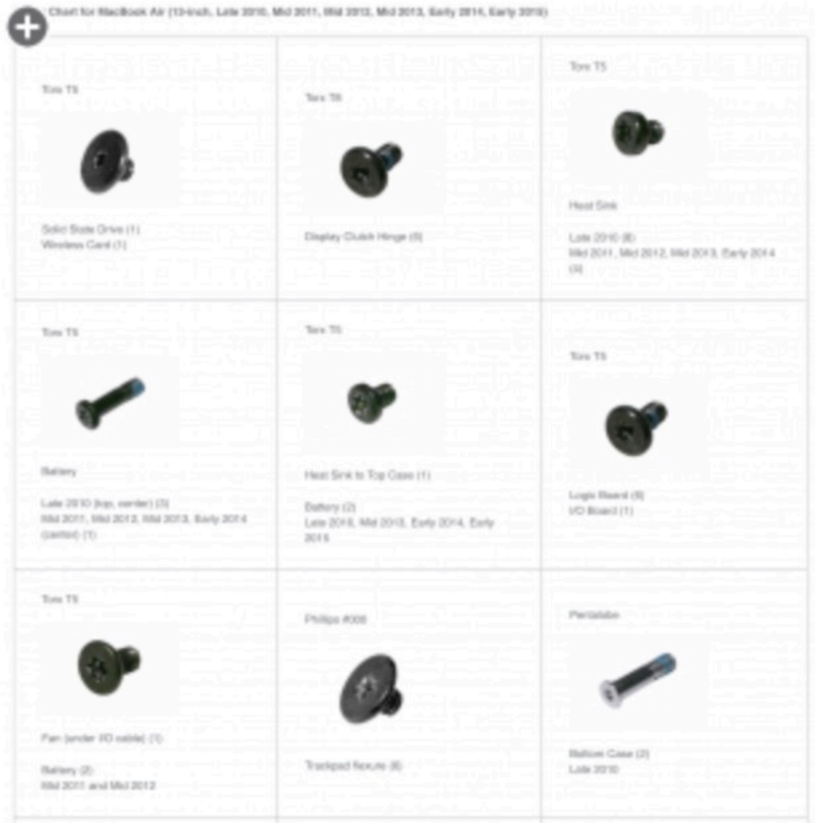
Service Guides

Views

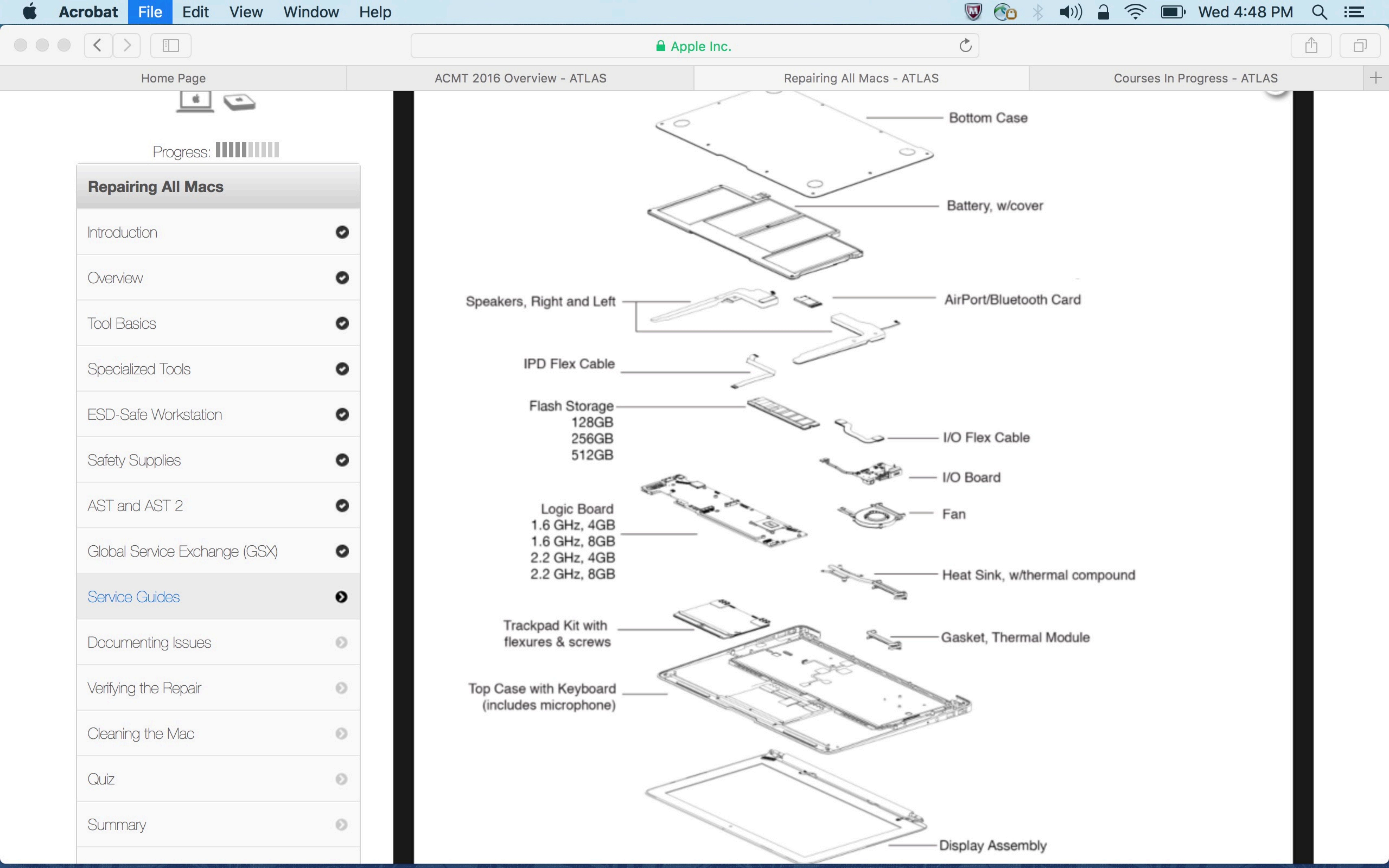
The Views section is designed to help you identify parts, screws, and the physical location of these components in a specific product. Most service guides include an Exploded view of all parts and a Screw Chart with screw images an locations.


Bottom Case
Battery, w/cover
Speakers, Right and Left
AirPort/Bluetooth Card
IPD Flex Cable
Flash Storage 128GB 256GB 512GB
I/O Flex Cable
I/O Board
Fan
Logic Board 1.6 GHz, 4GB 1.6 GHz, 8GB 2.2 GHz, 4GB 2.2 GHz, 8GB
Heat Sink, w/thermal compound
Trackpad Kit with fasteners & screws
Gasket, Thermal Module
Top Case with Keyboard (includes microphone)
Display Assembly

Exploded View



Screw Chart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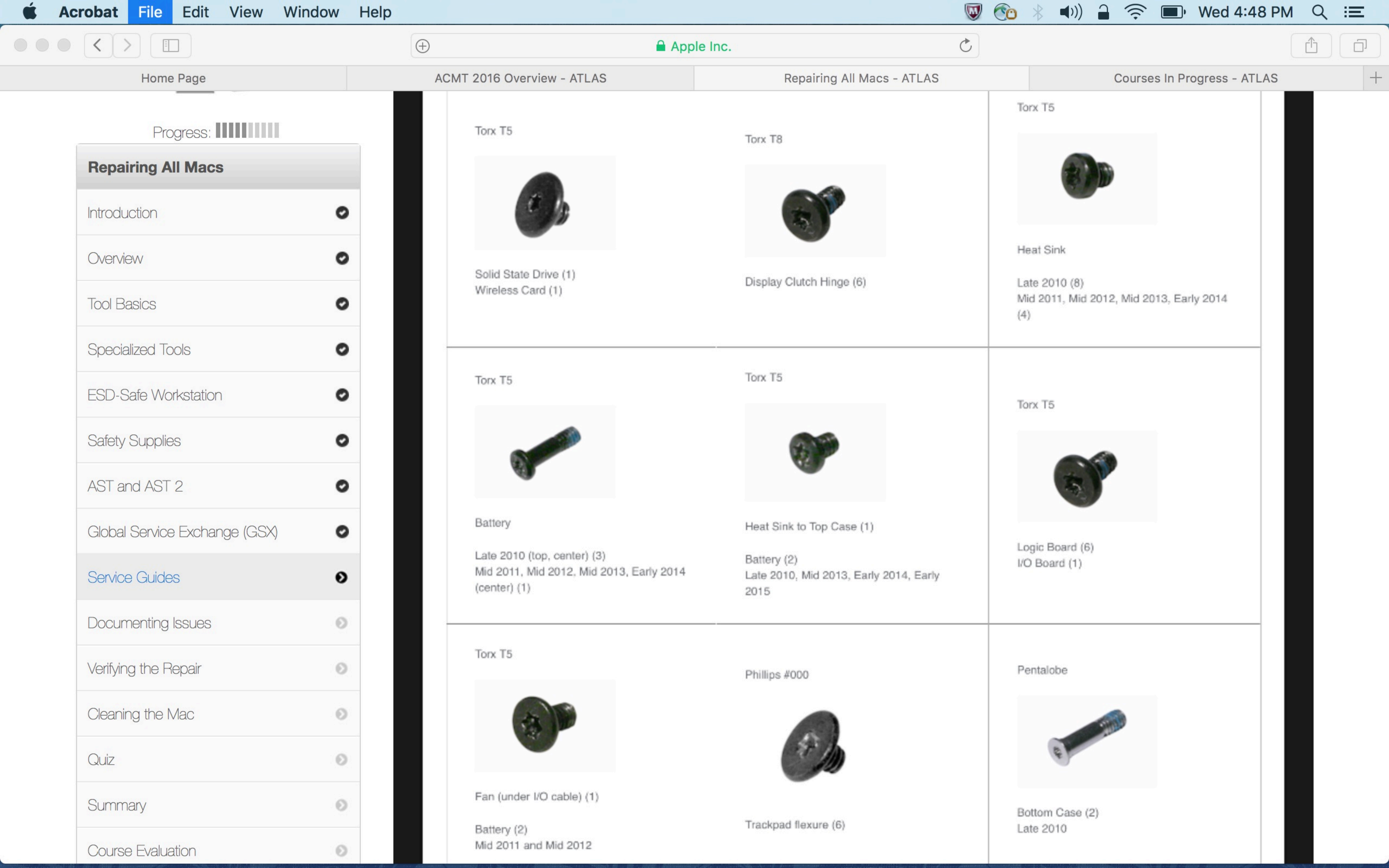

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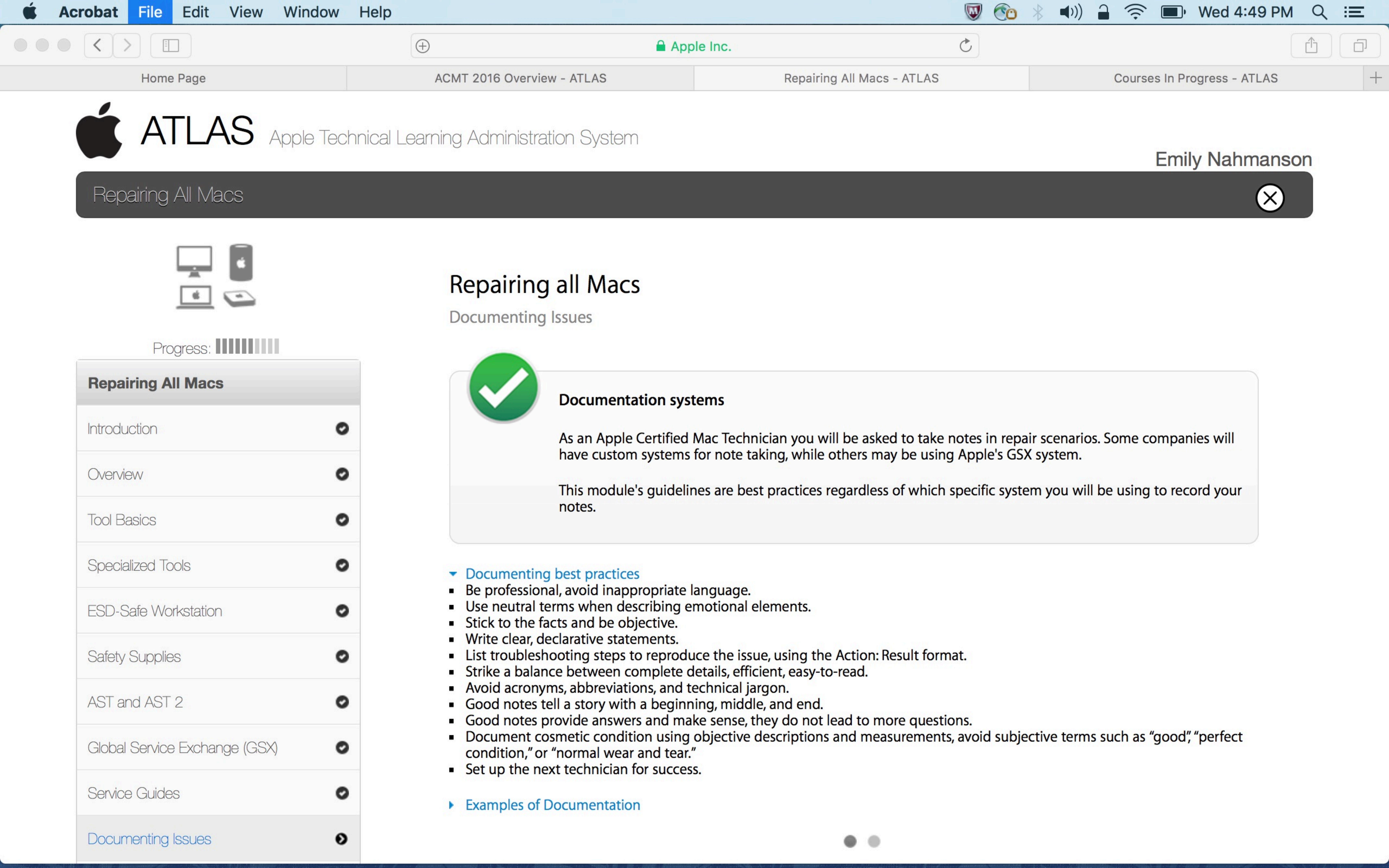
Torx T5 Solid State Drive (1) Wireless Card (1)	Torx T8 Display Clutch Hinge (6)	Torx T5 Heat Sink Late 2010 (8) Mid 2011, Mid 2012, Mid 2013, Early 2014 (4)
Torx T5 Battery Late 2010 (top, center) (3) Mid 2011, Mid 2012, Mid 2013, Early 2014 (center) (1)	Torx T5 Heat Sink to Top Case (1) Battery (2) Late 2010, Mid 2013, Early 2014, Early 2015	Torx T5 Logic Board (6) I/O Board (1)
Torx T5 Fan (under I/O cable) (1) Battery (2) Mid 2011 and Mid 2012	Phillips #000 Trackpad flexure (6)	Pentalobe Bottom Case (2) Late 2010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Documenting Issues

Documentation systems

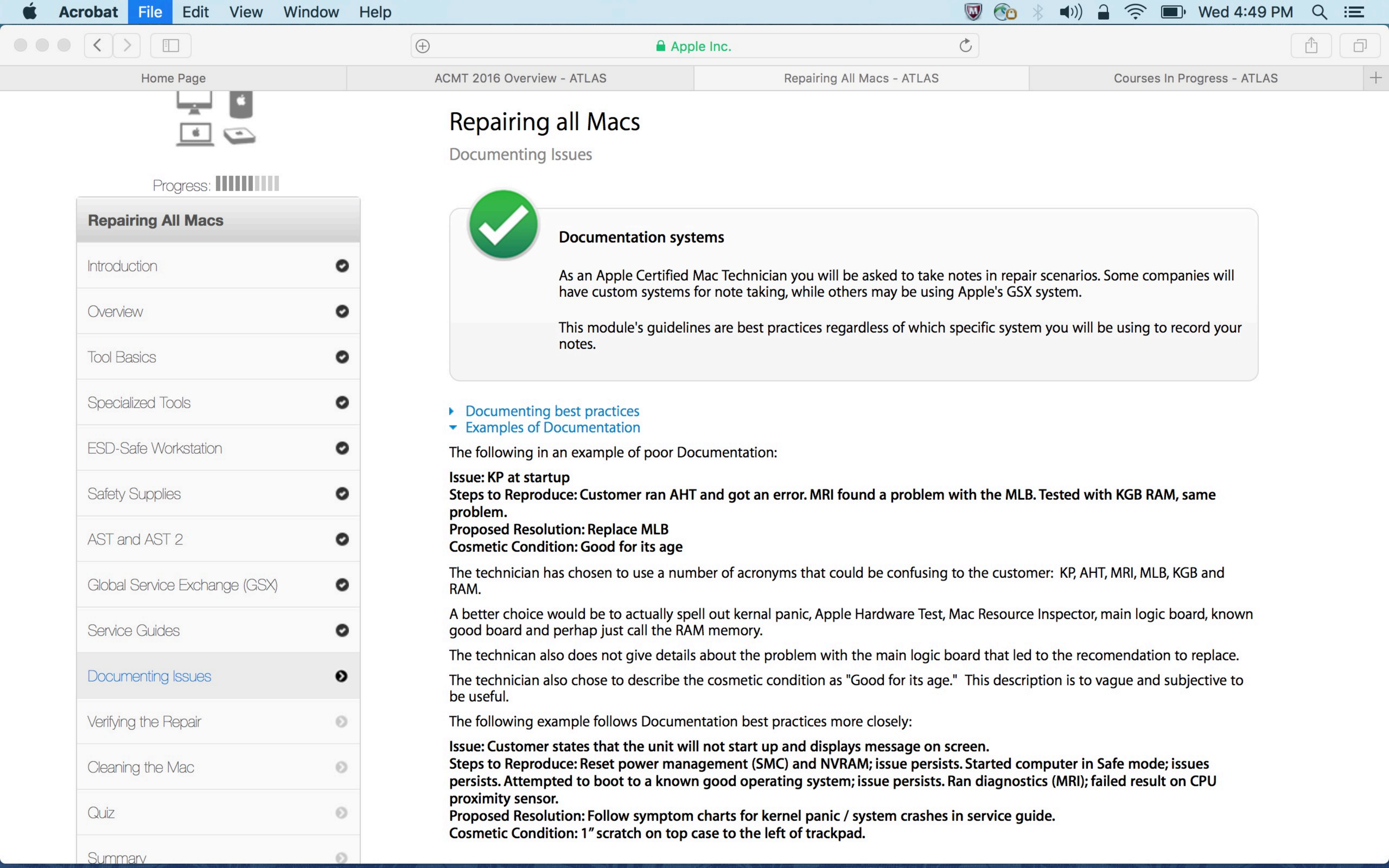
As an Apple Certified Mac Technician you will be asked to take notes in repair scenarios. Some companies will have custom systems for note taking, while others may be using Apple's GSX system.

This module's guidelines are best practices regardless of which specific system you will be using to record your notes.

▾ Documenting best practices

- Be professional, avoid inappropriate language.
- Use neutral terms when describing emotional elements.
- Stick to the facts and be objective.
- Write clear, declarative statements.
- List troubleshooting steps to reproduce the issue, using the Action: Result format.
- Strike a balance between complete details, efficient, easy-to-read.
- Avoid acronyms, abbreviations, and technical jargon.
- Good notes tell a story with a beginning, middle, and end.
- Good notes provide answers and make sense, they do not lead to more questions.
- Document cosmetic condition using objective descriptions and measurements, avoid subjective terms such as “good”, “perfect condition,” or “normal wear and tear.”
- Set up the next technician for success.

▸ Examples of Documentation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Documenting Issues

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▸ Documenting best practices

▾ Examples of Documentation

The following in an example of poor Documentation:

Issue: KP at startup
Steps to Reproduce: Customer ran AHT and got an error. MRI found a problem with the MLB. Tested with KGB RAM, same problem.
Proposed Resolution: Replace MLB
Cosmetic Condition: Good for its age

The technician has chosen to use a number of acronyms that could be confusing to the customer: KP, AHT, MRI, MLB, KGB and RAM.

A better choice would be to actually spell out kernal panic, Apple Hardware Test, Mac Resource Inspector, main logic board, known good board and perhap just call the RAM memory.

The technican also does not give details about the problem with the main logic board that led to the recomendation to replace.

The technician also chose to describe the cosmetic condition as "Good for its age." This description is to vague and subjective to be useful.

The following example follows Documentation best practices more closely:

Issue: Customer states that the unit will not start up and displays message on screen.
Steps to Reproduce: Reset power management (SMC) and NVRAM; issue persists. Started computer in Safe mode; issues persists. Attempted to boot to a known good operating system; issue persists. Ran diagnostics (MRI); failed result on CPU proximity sensor.
Proposed Resolution: Follow symptom charts for kernel panic / system crashes in service guide.
Cosmetic Condition: 1" scratch on top case to the left of trackpad.

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ATLAS Apple Technical Learning Administration System

Emily Nahmanson

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Repairing all Macs

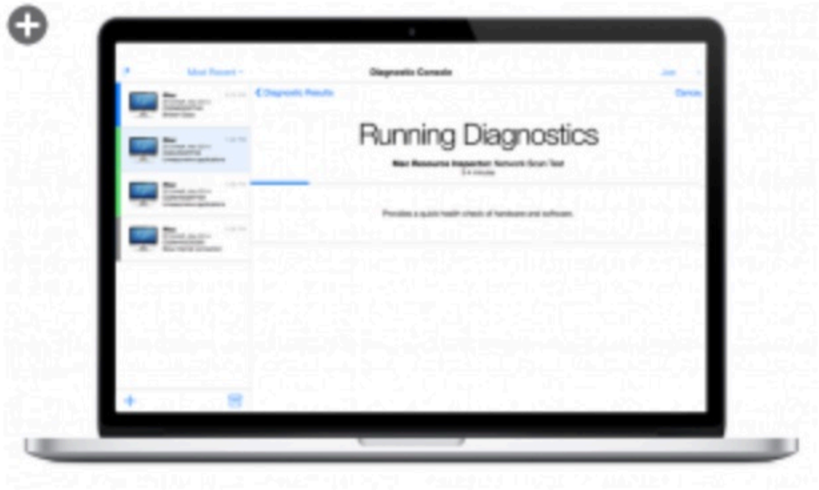
Verifying the Repair

What to check when verifying the repair?

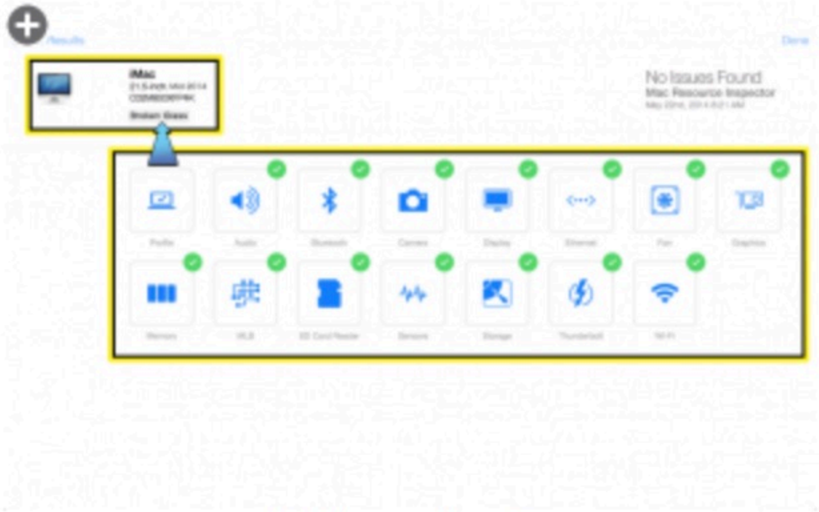
After repairs are complete use these as guidelines:

- The original customer issue has been resolved.
- No new issues have been introduce during the repair.
- The Mac will pass required diagnostics.

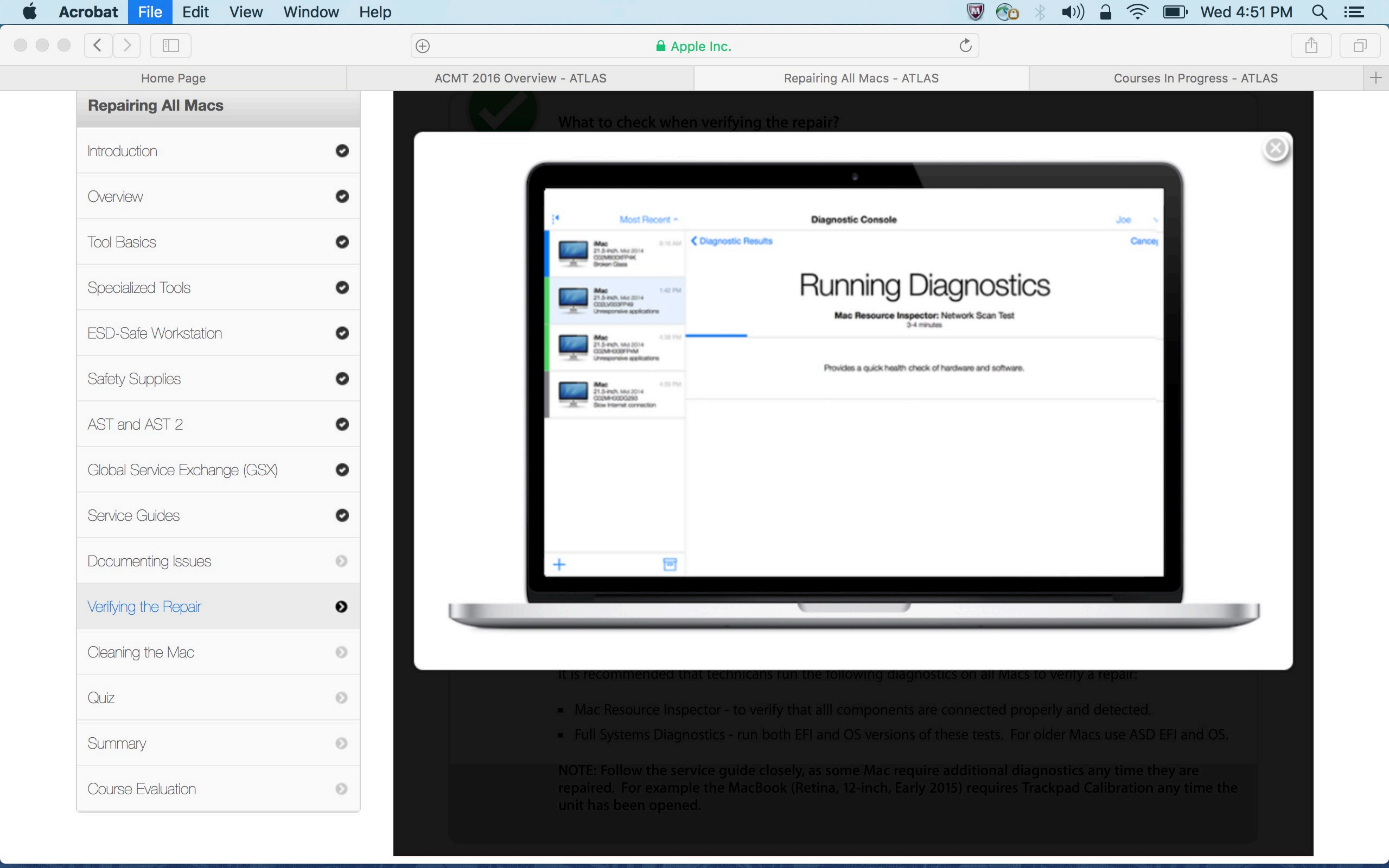
If these three criteria are not met, return to troubleshooting.



Diagnostic Console



Mac Resource Inspector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Joe
Diagnostic Results
Cancel
iMac

What to check when verifying the repair?

Running Diagnostics

Mac Resource Inspector: Network Scan Test

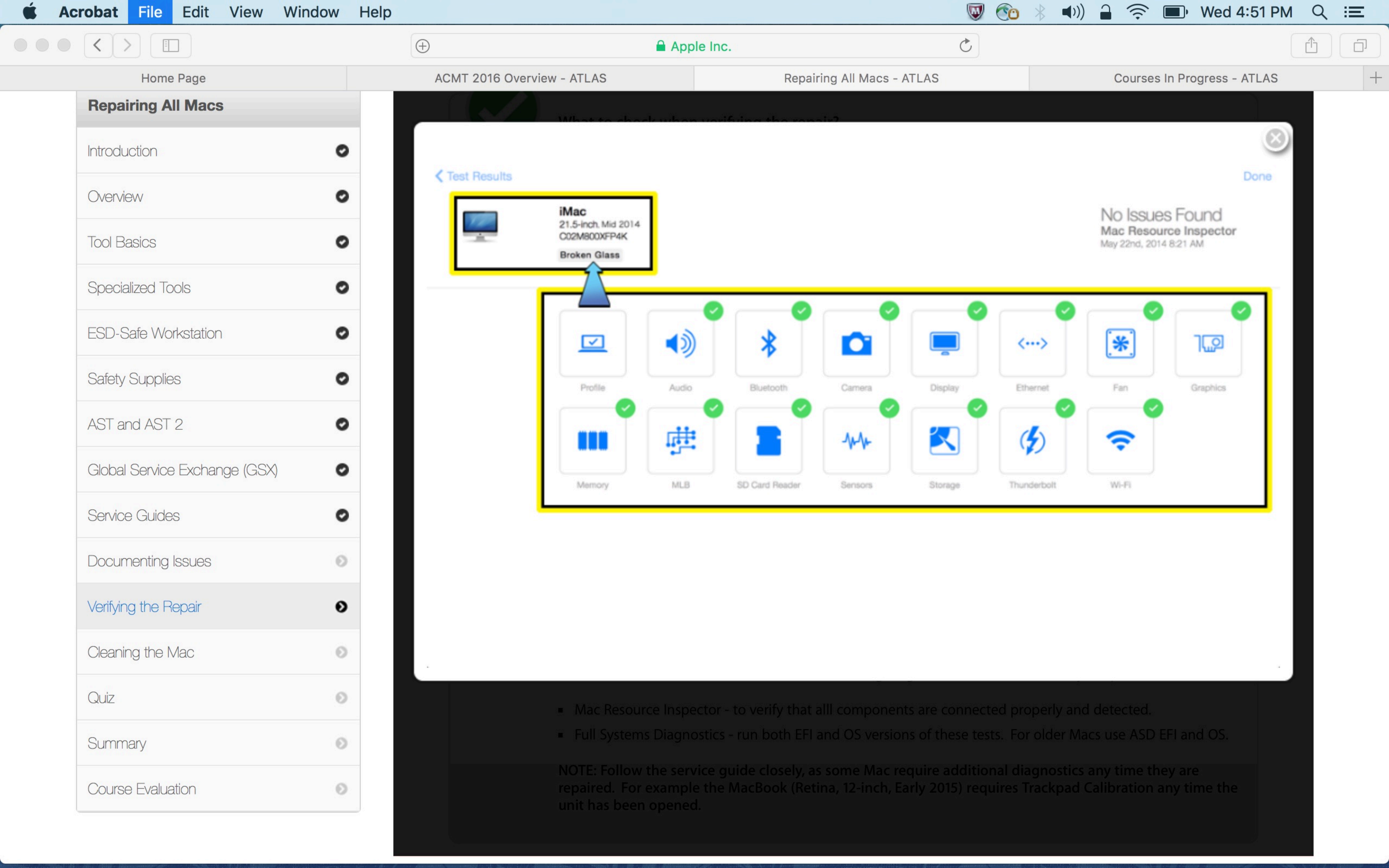
3-4 minutes

Provides a quick health check of hardware and software.

It is recommended that technicans run the following diagnostics on all Macs to verify a repair:

- Mac Resource Inspector - to verify that alll components are connected properly and detected.
- Full Systems Diagnostics - run both EFI and OS versions of these tests. For older Macs use ASD EFI and OS.

NOTE: Follow the service guide closely, as some Mac require additional diagnostics any time they are repaired. For example the MacBook (Retina, 12-inch, Early 2015) requires Trackpad Calibration any time the unit has been opened.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Bluetooth
Camera
Display
Ethernet
Fan
Graphics
Memory
MLB
SD Card Reader
Sensors
Storage
Thunderbolt
Wi-Fi

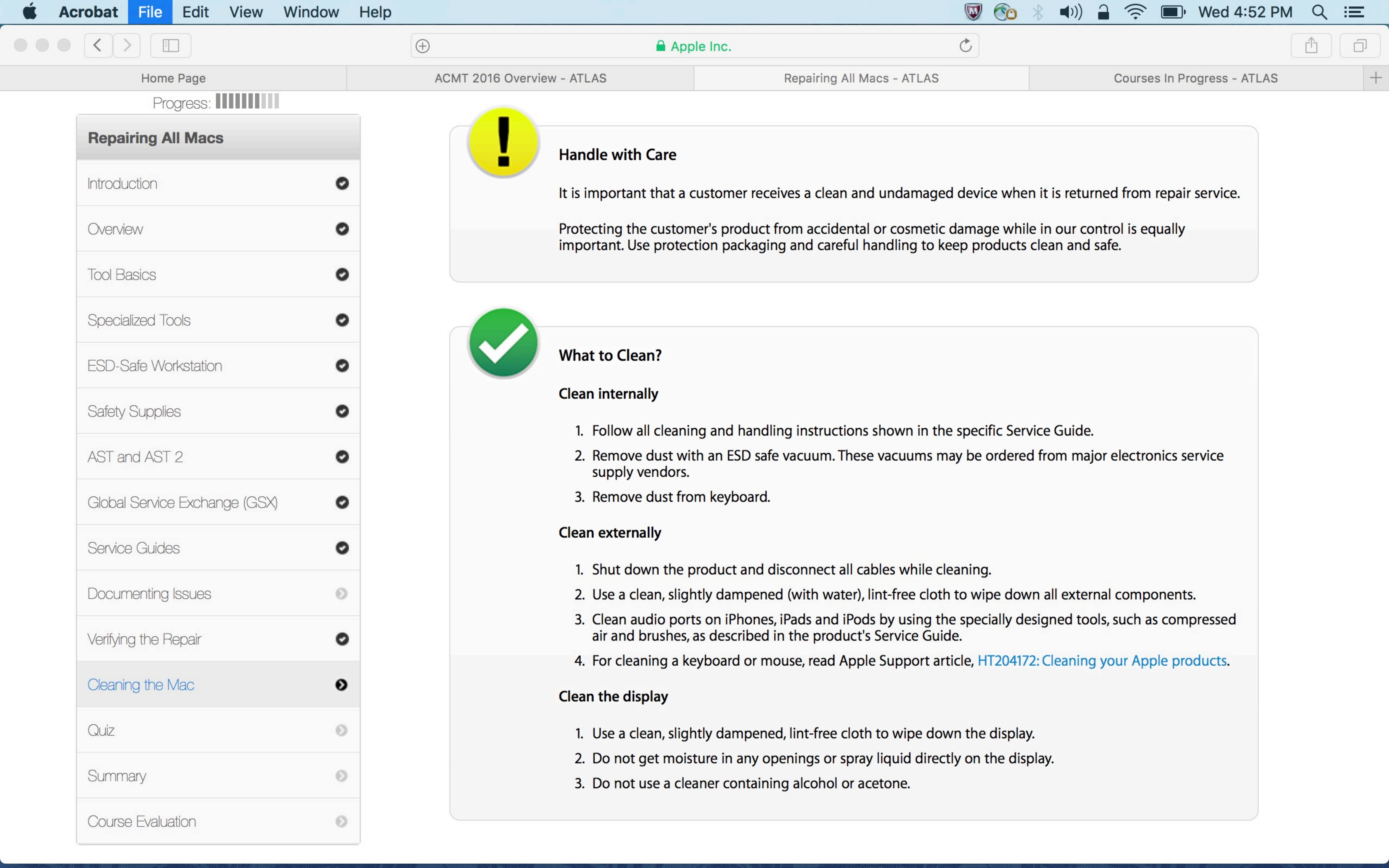
What to check when verifying the repair?

iMac
21.5-inch, Mid 2014
C02M800XFP4K
Broken Glass

No Issues Found
Mac Resource Inspector
May 22nd, 2014 8:21 AM

- Mac Resource Inspector - to verify that alll components are connected properly and detected.
- Full Systems Diagnostics - run both EFI and OS versions of these tests. For older Macs use ASD EFI and OS.

NOTE: Follow the service guide closely, as some Mac require additional diagnostics any time they are repaired. For example the MacBook (Retina, 12-inch, Early 2015) requires Trackpad Calibration any time the unit has been opened.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Handle with Care

It is important that a customer receives a clean and undamaged device when it is returned from repair service.

Protecting the customer's product from accidental or cosmetic damage while in our control is equally important. Use protection packaging and careful handling to keep products clean and safe.

What to Clean?

Clean internally

1. Follow all cleaning and handling instructions shown in the specific Service Guide.
2. Remove dust with an ESD safe vacuum. These vacuums may be ordered from major electronics service supply vendors.
3. Remove dust from keyboard.

Clean externally

1. Shut down the product and disconnect all cables while cleaning.
2. Use a clean, slightly dampened (with water), lint-free cloth to wipe down all external components.
3. Clean audio ports on iPhones, iPads and iPods by using the specially designed tools, such as compressed air and brushes, as described in the product's Service Guide.
4. For cleaning a keyboard or mouse, read Apple Support article, HT204172: Cleaning your Apple products.

Clean the display

1. Use a clean, slightly dampened, lint-free cloth to wipe down the display.
2. Do not get moisture in any openings or spray liquid directly on the display.
3. Do not use a cleaner containing alcohol or acetone.