

Model Design and Building

Merit Badge Workbook



Merit badges are earned by doing: reading the pamphlet, practicing the skills, and showing your counselor what you have learned.
This workbook gives you a place to organize your notes and track your progress along the way.
Merit badge counselors may not require the use of this or any similar workbook.
You still must satisfy your counselor that you can demonstrate each skill and have learned the information.
Use the space under each requirement to note what you have done and what you want to talk about, not to write out full answers.
When a requirement says discuss, show, tell, explain, or demonstrate, that is what you must do.
No one may add to or subtract from the official requirements found on scouting.org (Guide to Advancement 7.0.4.8).
Scouting America last updated this badge's requirements page on December 31, 2025.
Requirements change from time to time. Double-check scouting.org before you start.

Scout's name: _____ Unit: _____ Date started: _____

Counselor's name: _____ Phone no.: _____ Email: _____

Links marked "Scouting America resources" are the ones Scouting America shares on its official badge page.
This workbook is unofficial and not endorsed by Scouting America.

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1. Safety. Discuss all safety procedures with your counselor before beginning your modelmaking project, and explain why each is important—both in traditional and computer-assisted design and construction:

(a) Explain the requirements for personal safety when using modelmaking hand tools, and when to use proper protective equipment.

Scouting America resources: Toolbox Talk on Hand Safety | This Is Why You Should Be Wearing Gloves (video)
X-Acto Knife: Basic Safe Use in Under 4 Minutes (video) · 3-D Printing Safety (website)
5-Minute 3D-Printing Training—Safety & Basics (video) · 3D Printer Resin: Proper Precautions You Must Take (video)

Hand tool safety

Tool	How I use it safely	Protective equipment and when	Why it matters

(b) Explain digital safety best practices when using computer design software, and digital fabrication tools.

Scouting America resources: Digital Safety (video)

Digital safety practices for design software and digital fabrication tools, and why each matters

(c) Explain what precautions to take when using flammable or hazardous materials.

Scouting America resources: Flammable Liquids—Safe Handling: Essential Tips for Workplace Safety (video)
Is Super Glue Non-Toxic? The Real Dangers Explained (website) · 6 Health and Safety Tips Every Painter Should Know (video)

Precautions for flammable or hazardous materials, and why each matters

Requirement 1 completed on _____ counselor initials _____

2. Types of Models and Materials. Do the following:

(a) Explain the uses for each of the following types of models: architectural, structural, process, mechanical, and industrial.

Scouting America resources: 10 Types of Architecture Models and How To Make Them (website)
12 Building Models That Architects Deliver (website) · Model Types and Uses (PDF)

Types of models

Type of model	What it is used for
architectural	
structural	
process	
mechanical	
industrial	

(b) Explain to your counselor how either traditional and/or computer design tools can be used to create plans, simulate function, visualize models, and assist in constructing or fabricating parts.

Scouting America resources: What Is CAD?—Computer-Aided Design Explained (video)

How design tools help

Use	Traditional or computer tool	How it helps
create plans		
simulate function		
visualize models		
assist in constructing or fabricating parts		

(c) Describe to your counselor traditional and modern materials and fabrication methods that can be used for making these models. Include physical and digital materials and methods.

Scouting America resources: Architectural Model Making — Material Selection—An Architect's Guide (Part 2) (video)
3D Printing 101: The Ultimate Beginner's Guide (video)

Materials and fabrication methods

Material or method	Traditional or modern	Physical or digital	What it is good for

Requirement 2 completed on _____ counselor initials _____

3. Planning Your Project. With your counselor's advice, select a subject from requirement 4 for your model project. (You must not use a pre-made kit; your project must be your original design.) Do the following:

My subject (from requirement 4) _____ Counselor OK date _____

(a) Prepare the necessary plans to the proper scale.

Scale _____

My plans to scale (draw here or attach)

(b) Make a list of materials.

Scouting America resources: Glues for Plastic Models and How To Use Them (video)

My list of materials

Material	How much	Where I will get it

(c) Create a list of the required tools.

Scouting America resources: Best Scale Modeling Supplies for Beginners | 10 Essential Tools To Get Started (video)
Building Your First Scale Model Car: Basic Hand Tools (video)

Tools I need

Tool	What I will use it for

(d) This model should be your own original work. Tell why you selected this subject.

Why I selected this subject

(e) Discuss with your counselor if you plan to integrate computer design tools to complete your project.

Computer design tools I plan to use, if any, and how

Requirement 3 completed on _____ counselor initials _____

4. Build Your Model. Do ONE of the following using physical and/or computer design methods. Before beginning any model, discuss your approach with your counselor, including the possible use of computer design software such as CAD or 3D modeling tools. Present your plans and completed model to your counselor.

Approach discussed with counselor on _____ Plans and model presented on _____

☐ **(a)** Architectural Model. Design and build a model of a house to a scale of 1/4" = 1'0" (1:48 scale). Begin by creating floor plans and elevations. Include windows, doors, and structural elements. Discuss with your counselor the materials you intend to use, the amount of detail required, outside treatment (finish, shrubbery, walks, etc.), and color selections. You may choose to 3D print elements or use laser-cut parts based on using computer design. Present both your design and final model to your counselor for evaluation.

Scouting America resources: How To Read an Architectural Scale Where 1/4"=1' (video)
Architectural Model Making Tips + Tricks—An Architect's Guide (video) · 30 Minute Study Model—Here's How (video)
How To Make Trees and People for Architecture Scale Models (video)
Adam Savage's One Day Builds: Wood Architectural Model! (video)

- ☐ Floor plans
- ☐ Elevations
- ☐ Windows
- ☐ Doors
- ☐ Structural elements

My floor plans and elevations (draw here or attach)

Materials, detail, outside treatment, and colors I discussed with my counselor

☐ **(b)** Structural Model. Construct a scale model showing corner construction of a wood-frame building to a scale of 1 1/2" = 1'0" (1:8 scale). Begin with a structural layout showing the parts of the floor and wall frames, such as intermediate girder, joist, bridging, subfloor, sill, sole plate, stud, and rafter. Use your plans to assist in building a physical model with cardboard, foam board, or wood. Review with your counselor the parts of the structure and discuss challenges in both your design and build process, gathering the materials and supporting the structure.

Scouting America resources: How To Read an Architectural Scale Where 1-1/2"=1' (video)

Parts in my structural layout

Part	Where it is in my model
intermediate girder	
joist	
bridging	
subfloor	
sill	
sole plate	
stud	
rafter	

Material I built with _____ Reviewed with counselor on _____

Challenges in my design and build (materials, supporting the structure)

☐ **(c)** Process Model. Design and build a model showing the plumbing system of your house to a scale of 3/4" = 1'0" (1:16 scale) or an agreed-upon scale. Show hot and cold-water supply, all waste returns, and venting. After creating your plan, talk to your counselor about how to begin this model, and present the scale and the materials you will use. Build the model using appropriate materials such as tubing, straws, or printed parts. After completion, present your model to your counselor, and be prepared to discuss any problems you had building this model.

Scouting America resources: How To Read and Use an Architect's Scale for Beginners (video)

Scale _____ Materials _____

☐ Hot water supply
☐ Cold water supply
☐ All waste returns
☐ Venting

Problems I had building this model

☐ **(d)** Mechanical Model. Build a model of a mechanical device that incorporates at least two of the six simple machines. You can use digital tools to design and simulate the device before constructing it. Once your design is approved by your counselor, build a working physical model using materials such as wood, plastic, or 3D printed parts. Present your models to your counselor and be prepared to discuss materials used, the machine's function, and challenges you encountered during the construction process.

Scouting America resources: Simple Machines (video) · Examples of Simple Machines Used in Everyday Life (video)

My mechanical device _____ Design approved on _____

Simple machines in my device

Simple machine	What it does in my device

Materials used, the machine's function, and challenges I encountered

☐ **(e)** Industrial Model. Build a model of an actual passenger-carrying vehicle to a scale of 1" = 1'0" or 1/2" = 1'0" (1:12 or 1:24 scale). Begin by measuring a real vehicle and modeling it from multiple views (top, front, rear, sides). You can draw it or use computer design software. From your plans, build a physical model or use digital rendering or 3D printing to produce the final version. Discuss with your counselor which parts were most challenging.

Scouting America resources: How To Read an Architectural Scale Where 1"=1' (video) · Orthographic Drawing—Simplified (video) 5 Ways To Sketch a Car With Accurate Proportions (website)

Vehicle _____ Scale _____

☐ Top view ☐ Rear view
☐ Front view ☐ Side views

Parts that were most challenging

Requirement 4 completed on _____ counselor initials _____

5. Special-Effects Fantasy Model. Design and build a fantasy spacecraft model suitable for a science-fiction film, using traditional modeling and/or computer design techniques. Determine an appropriate scale for your design—one that makes practical sense. Do the following:

Scouting America resources: Easy Spaceship Modeling Techniques! (video)
Adam Savage's One Day Builds: Kit-Bashing and Scratch-Building! (video)

My spacecraft _____ Scale I chose _____

(a) Research real-world aircraft, submarines, and naval ships for design inspiration.

Scouting America resources: 5 Most Influential Submarine Designs Ever (website)
15 Future Aircraft Designs That Will Blow Your Mind (video)

My design research

Type	Real example I looked at	Design ideas I took from it
aircraft		
submarines		
naval ships		

(b) Design individual components (such as the cockpit, living areas, engines, and storage).

My components

Component	My design notes
cockpit	
living areas	
engines	
storage	

(c) Produce a final sketch or a rendered image of the complete model from multiple angles.

My final sketch from multiple angles (draw here or attach a rendered image)

(d) Discuss your design process and scale choices with your counselor. Describe the materials (physical and/or digital) you used, how you engineered your model and discuss any difficulties you encountered and what you learned.

My design process and scale choices

Materials I used, how I engineered my model, difficulties, and what I learned

Requirement 5 completed on _____ counselor initials _____

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6. Careers. Explore careers related to this merit badge. Research one career to learn about the training and education needed, costs, job prospects, salary, job duties, and career advancement. Your research methods may include—with your parent or guardian's permission—an internet or library search, an interview with a professional in the field, or a visit to a location where people in this career work. Discuss with your counselor both your findings and what about this profession might make it an interesting career.

Scouting America resources: How To Be a Professional Model Maker—My Journey (video) · How To Get a Job in 3D Printing (video) 30 Jobs for Model Makers (Precision Pioneers) (website)

Careers related to model design and building

Career	What they do

The career I researched

Topic	What I found
Training and education	
Costs	
Job prospects	
Salary	
Job duties	
Career advancement	

What might make it an interesting career

Requirement 6 completed on _____ counselor initials _____

Counselor sign-off

Your counselor signs your blue card or approves the badge in Scoutbook, and your unit records it. This line is for your own records.

Counselor's signature _____ Date completed _____

Official Scouting America resources

Scouting America resources: Model Design and Building merit badge page (requirements and resources) Model Design and Building merit badge pamphlet (free PDF) · All merit badges

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