

MERIT BADGE SERIES



MODEL DESIGN AND BUILDING



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STEM-Based

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"Enhancing our youths' competitive edge through merit badges"



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Model Design and Building

1. Study and understand the requirements for personal safety when using such modelmaker hand tools as knives, handsaws, vises, files, hammers, screwdrivers, hand drills and drill bits, pliers, and portable power tools, and when to use proper protective equipment such as goggles when grinding or drilling. Know what precautions to take when using flammable or hazardous products such as glue, epoxy, paint, and thinners. Discuss these with your counselor before you begin your modelmaking project and tell why they are important.
2. Explain the uses for each of the following types of models: architectural, structural, process, mechanical, and industrial. Do research into the different types of materials that could be used in making these models.
3. With your counselor's advice, select a subject from requirement 4 for your model project. Kits may not be used. Prepare the necessary plans to the proper scale. This model should be your own original work. Tell your counselor why you selected this project
4. Do ONE of the following:
 - (a) Make an architectural model. Build a model of a house to a scale of $\frac{1}{4}'' = 1'0''$ (1:50 scale). After completing the model, present it to your counselor for approval. Review with your counselor the materials you used and the details of your model.
 - (b) Build a structural model. Construct a model showing corner construction of a wood-frame building to a scale of $1\frac{1}{2}'' = 1'0''$ (1:8 scale). All structures shown must be to scale. Cardboard or flat sheet wood stock may be used for sheeting or flooring on the model. Review with your counselor the problems you encountered in gathering the materials and supporting the structure. Be able to name the parts of the floor and wall frames, such as intermediate girder, joist, bridging, subfloor, sill, sole plate, stud, and rafter.
 - (c) Make a process model. Build a model showing the plumbing system in your house. Show hot and cold water supply, all waste returns, and venting to a scale of $\frac{3}{4}'' = 1'0''$ (1:15 scale). After completion, present the model to your counselor. Discuss the scale, the materials used, and any problems you encountered in building the model.
 - (d) Complete a mechanical model. Build a model of a mechanical device that uses at least two of the six simple machines. After completing the model, present it to your counselor. Be prepared to discuss materials used, the machine's function, and any particular difficulty you might have encountered.

- (e) Make an industrial model. Build a model of an actual passenger-carrying vehicle to a scale of $1" = 1'0"$ or $1/2" = 1'0"$ (1:10 or 1:25 scale). Take the dimensions of the vehicle and record the important dimensions. Draw the top, front, rear, and sides of the vehicle to scale. From your plans, build a model of the vehicle. Discuss with your counselor the most difficult part of completing the model.
5. Build a special-effects model of a fantasy spacecraft or a hand-held prop that might appear in a Hollywood science-fiction movie. Determine an appropriate scale for your design. Include a cockpit or control area, living space, storage unit, engineering spaces, and propulsion systems. As you plan and build your model, do the following:
- (a) Study existing designs of vehicles and hand-held devices.
 - (b) Arrange and assemble the parts.
 - (c) Sketch your completed model.
 - (d) Discuss your design, scale, and materials choices with your counselor. Describe how you engineered your model and discuss any difficulties you encountered and what you learned.
6. List at least six occupations in which modelmaking is used and discuss with your counselor some career opportunities in this field.

Model Design and Building Resources

Scouting Literature

Architecture, Art, Auto Mechanics, Aviation, Engineering, Railroad, Robotics, and Woodwork merit badge pamphlets

Visit the Boy Scouts of America's official retail website at <http://www.scoutstuff.org> for a complete listing of all merit badge pamphlets and other helpful Scouting materials and supplies.

Books

Bridgewater, Alan, and Gill Bridgewater. *Making More Wooden Mechanical Models*. Popular Woodworking Books, 1999.

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Congdon, Roark T. *Architectural Model Building: Tools, Techniques, and Materials*. Fairchild Books, 2010.

Covert, Pat. *Building and Detailing Scale Model Cars*. Specialty Press, 2006.

FineScale Modeler. *Scale Model Detailing: Projects You Can Do*. Kalmbach Publishing, 1995.

Hansen, Lawrence. *The Basics of Scale Modeling*. Kalmbach Publishing, 2005.

Leaf, Edwin B. *Ship Modeling From Scratch*. McGraw-Hill, 1994.

Levy, Raymond. *Making Mechanical Marvels in Wood*. Sterling, 1991.

Marmo, Richard. *How to Build Sci-Fi Model Spacecraft*. Specialty Press, 2004.

Naval Education and Training Program Development Center. *Basic Machines and How They Work*. BN Publishing, 2008.

Salvadori, Mario G. *The Art of Construction: Projects and Principles for Beginning Engineers and Architects*. Chicago Review Press, 2000.

Werner, Megan. *Model Making*. Princeton Architectural Press, 2011.

Wilson, Jeff. *Modeler's Guide to Realistic Painting and Finishing*. Kalmbach Publishing, 2006.

Magazines

FineScale Modeler

Toll-free telephone: 800-533-6644
Website: <http://www.finescale.com>

Model Airplane News

Toll-free telephone: 800-827-0323
Website: <http://www.modelairplanenews.com>

Scale Auto Magazine

Toll-free telephone: 800-533-6644
Website: <http://www.scaleautomag.com>

Organizations and Websites

Academy of Model Aeronautics

Toll-free telephone: 800-435-9262

Website: <http://www.modelaircraft.org>

Association of Professional Model Makers

Telephone: 315-750-0803

Website: <http://www.modelmakers.org>

The Association of Professional Model Makers maintains a complete list of colleges and universities that offer modelmaking-related programs. Visit <http://www.modelmakers.org/colleges--universities-list>.

International Plastic Modelers' Society USA

Website: <http://www.ipmsusa.org>

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