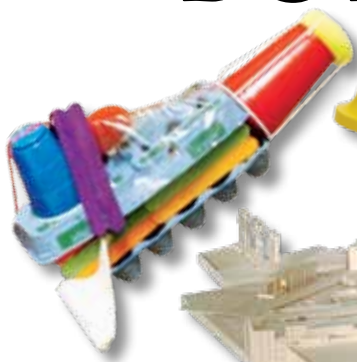


MERIT BADGE SERIES



MODEL DESIGN AND BUILDING



BOY SCOUTS OF AMERICA®

STEM-Based

BOY SCOUTS OF AMERICA
MERIT BADGE SERIES

MODEL DESIGN AND BUILDING



"Enhancing our youths' competitive edge through merit badges"



BOY SCOUTS OF AMERICA®

Requirements

1. Study and understand the requirements for personal safety when using such modelmaker hand tools as knives, hand-saws, 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 (no kits).

Prepare the necessary plans to the proper scale. Make a list of materials and a list of the required tools. This model should be your own original work. Tell why you selected this subject.



4. Do ONE of the following:
- a. Make an architectural model. Build a model of a house to a scale of $\frac{1}{4}" = 1'0"$ (50:1 metric). Discuss with your counselor the materials you intend to use, the amount of detail required, outside treatment (finish, shrubbery, walks, etc.), and color selections. After completing the model, present it to your counselor for approval.
 - b. Build a structural model. Construct a model showing corner construction of a wood-frame building to a scale of $1\frac{1}{2}" = 1'0"$ (8:1 metric). All structures shown must be to scale. Cardboard or flat sheet wood stock may be used for sheathing 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 $\frac{3}{4}" = 1'0"$ (15:1 metric). Talk to your counselor about how to begin this model, and present the scale and the materials you will use. After completion, present the model to your counselor, and be prepared to discuss any problems you had building this 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 $\frac{1}{2}" = 1'0"$ (10:1 or 25:1 metric). 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 and finish it in a craftsmanlike manner. Discuss with your counselor the most difficult part of completing the model.

5. Build a special-effects model of a fantasy spacecraft that might appear in a Hollywood science-fiction movie. Determine an appropriate scale for your design—one that makes practical sense. 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 aircraft, submarines, and naval ships for design ideas.
 - b. Arrange and assemble the parts.
 - c. Sketch your completed model.
 - d. Write a short essay in which you discuss your design, scale, and materials choices. Describe how you engineered your model and discuss any difficulties you encountered and what you learned.
6. Find out about three career opportunities in modelmaking. Pick one and find out the education, training, and experience required for this profession. Discuss this with your counselor, and explain why this profession might interest you.



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.

———. *Making Wooden Mechanical Models*. Popular Woodworking Books, 1995.

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>

Acknowledgments

The Boy Scouts of America is grateful to Jim Dore, AMS Phoenix Company, El Cajon, Calif., for his technical expertise and his role in revising the 2003 edition of *Model Design and Building*, upon which this edition is based.

The Boy Scouts of America is grateful to the men and women serving on the Merit Badge Maintenance Task Force for the improvements made in updating this pamphlet.

Photo and Illustration Credits

Comstock—page 9 (*car; bottom right*)

HKS Inc., courtesy—pages 41 and 42

Steve Howarth/www.modelminiatures.co.uk, courtesy—page 60

Jupiter.com—cover (*vise*); pages 2, 8 (*bottom*), 12 (*gloves*), 14 (*vise*), 16 (*cordless drill*), 19, 53, and 58

Stockbyte—page 9 (*top*)

Thinkstock/Ryan McVay—page 27

Wikipedia.org/Tobias Grosch—page 24 (*bottom left*)

Wikipedia.org/Glenn McKechnie—page 16 (*scriber*)

Wikipedia.org/Arthur Spicer (layout creator)/Eric Guinther (photographer)—page 24 (*bottom right*)

Wikipedia.org/Marcus Wong—page 47 (*bottom*)

All other photos and illustrations not mentioned above are the property of or are protected by the Boy Scouts of America.

Daniel Giles—page 12 (*right*)

John McDearmon—pages 20 (*both*), 21 (*top left*), 22 (*all*), 29–33 (*all*), 35–39 (*all*), 45–51 (*all illustrations*), and 54–55 (*all*)