



# Robotics

## Merit Badge Workbook

This workbook can help you but you still need to read the merit badge pamphlet.

The work space provided for each requirement should be used by the Scout to make notes for discussing the item with his counselor, not for providing the full and complete answers. Each Scout must do each requirement.

No one may add or subtract from the official requirements found in **Boy Scout Requirements** (Pub. 33216 – SKU 34765).

The requirements were last issued or revised in 2011 • This workbook was updated in April 2012.

Scout's Name: \_\_\_\_\_ Unit: \_\_\_\_\_

Counselor's Name: \_\_\_\_\_ Counselor's Phone No.: \_\_\_\_\_

<http://www.USScouts.Org> • <http://www.MeritBadge.Org>

Please submit errors, omissions, comments or suggestions about improving this workbook to: [Workbooks@USScouts.org](mailto:Workbooks@USScouts.org)

**NOTE: Requirements 4 and 5 require you to document your work in a robot engineering notebook. That notebook should be separate from and in addition to this workbook.**

1. **Safety.** Do each of the following:

- a. Explain to your counselor the most likely hazards you may encounter while working with robots and what you should do to anticipate, mitigate and prevent, and respond to these hazards.

Hazard: \_\_\_\_\_

Anticipate: \_\_\_\_\_

Mitigate & Prevent: \_\_\_\_\_

Respond: \_\_\_\_\_

Hazard: \_\_\_\_\_

Anticipate: \_\_\_\_\_

Mitigate & Prevent: \_\_\_\_\_

Respond: \_\_\_\_\_

Hazard: \_\_\_\_\_

Anticipate: \_\_\_\_\_

Mitigate & Prevent: \_\_\_\_\_

Respond: \_\_\_\_\_

Hazard: \_\_\_\_\_

Anticipate: \_\_\_\_\_

Mitigate & Prevent: \_\_\_\_\_

Respond: \_\_\_\_\_

Hazard: \_\_\_\_\_

Anticipate: \_\_\_\_\_

Mitigate & Prevent: \_\_\_\_\_

Respond: \_\_\_\_\_

Describe the appropriate safety gear and clothing that should be used when working with robotics. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- b. Discuss first aid and prevention for the types of injuries that could occur while participating in robotics activities and competitions, including cuts, eye injuries, and burns (chemical or heat).

Cuts,: \_\_\_\_\_  
\_\_\_\_\_

Eye injuries: \_\_\_\_\_  
\_\_\_\_\_

Chemical Burns: \_\_\_\_\_  
\_\_\_\_\_

Heat burns: \_\_\_\_\_  
\_\_\_\_\_

2. **Robotics industry.** Discuss the following with your counselor:

- a. The kinds of things robots can do and how robots are best used today.

What they can do: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

How they are best used: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- b. The similarities and differences between remote-control vehicles, telerobots, and autonomous robots.

Similarities: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Differences: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

c. Three different methods robots can use to move themselves other than wheels or tracks.

- 1. \_\_\_\_\_
- 2. \_\_\_\_\_
- 3. \_\_\_\_\_

Describe when it would be appropriate to use each method.

- 1. \_\_\_\_\_  
\_\_\_\_\_
- 2. \_\_\_\_\_  
\_\_\_\_\_
- 3. \_\_\_\_\_  
\_\_\_\_\_

3. **General knowledge.** Discuss with your counselor three of the five major fields of robotics (human-robot interface, mobility, manipulation, programming, sensors) and their importance to robotics development. Discuss either the three fields as they relate to a single robot system OR talk about each field in general.

- 1. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 2. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 3. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Find pictures or at least one video to aid your discussion.

4. **Design, build, program, test.** Do each of the following:

- a. With your counselor's approval, choose a task for the robot or robotic subsystem that you plan to build. Include sensor feedback and programming in the task. Document this information in your robot engineering notebook.
- b. Design your robot. The robot design should use sensors and programming and have at least 2 degrees of freedom. Document the design in your robot engineering notebook using drawings and a written description.
- c. Build a robot or robotic subsystem of your original design to accomplish the task you chose for requirement 4a.

- d. Discuss with your counselor the programming options available for your robot. \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Then do either option 1 OR option 2.

- 1. **Option 1.** Program your robot to perform the task you chose for your robot in 4a. Include a sample of your program's source code in your robot engineering notebook.
- 2. **Option 2.** Prepare a flowchart of the desired steps to program your robot for accomplishing the task in 4a. Include procedures that show activities based on sensor inputs. Place this in your robot engineering notebook.

- e. Test your robot and record the results in your robot engineering notebook. Include suggestions on how you could improve your robot, as well as pictures or sketches of your finished robot.

5. **Demonstrate.** Do the following:

- a. Demonstrate for your counselor the robot you built in requirement 4.
- b. Share your robot engineering notebook with your counselor. Talk about how well your robot accomplished the task, the improvements you would make in your next design, and what you learned about the design process. \_\_\_\_\_

How well your robot accomplished the task: \_\_\_\_\_  
 \_\_\_\_\_

Improvements you would make: \_\_\_\_\_  
 \_\_\_\_\_

What you learned: \_\_\_\_\_  
 \_\_\_\_\_

6. **Competitions.** Do ONE of the following.

- a. Attend a robotics competition and report to your counselor what you saw and learned about the competition and how teams are organized and managed.

What you saw: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

What you learned: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

How teams are organized and managed.: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- b. Learn about three youth robotics competitions. Tell your counselor about these, including the type of competition, time commitment, age of the participants, and how many teams are involved.

Competition 1: \_\_\_\_\_

Type of competition: \_\_\_\_\_

Time commitment: \_\_\_\_\_

Age of the participants: \_\_\_\_\_

How many teams are involved: \_\_\_\_\_

Competition 2: \_\_\_\_\_

Type of competition: \_\_\_\_\_

Time commitment: \_\_\_\_\_

Age of the participants: \_\_\_\_\_

How many teams are involved: \_\_\_\_\_

Competition 3: \_\_\_\_\_

Type of competition: \_\_\_\_\_

Time commitment: \_\_\_\_\_

Age of the participants: \_\_\_\_\_

How many teams are involved: \_\_\_\_\_

7. **Careers.** Name three career opportunities in robotics.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

Pick one and find out the education, training, and experience required for this profession.

Education: \_\_\_\_\_

Training: \_\_\_\_\_

Experience: \_\_\_\_\_

Discuss this with your counselor, and explain why this profession might interest you. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

<p><b>Requirement resources can be found here:</b>  <a href="http://www.meritbadge.org/wiki/index.php/Robotics#Requirement_resources">http://www.meritbadge.org/wiki/index.php/Robotics#Requirement_resources</a></p>
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## Important excerpts from the [‘Guide To Advancement’](#), No. 33088:

Effective January 1, 2012, the ‘Guide to Advancement’ (which replaced the publication ‘Advancement Committee Policies and Procedures’) is now the official Boy Scouts of America source on advancement policies and procedures.

- **[ Inside front cover, and 5.0.1.4 ] — Unauthorized Changes to Advancement Program**  
**No council, committee, district, unit, or individual has the authority to add to, or subtract from, advancement requirements.**  
(There are limited exceptions relating only to youth members with disabilities. For details see section 10, “Advancement for Members With Special Needs”.)
- **[ Inside front cover, and 7.0.1.1 ] — The [‘Guide to Safe Scouting’](#) Applies**  
Policies and procedures outlined in the ‘Guide to Safe Scouting’, No. 34416, apply to all BSA activities, including those related to advancement and Eagle Scout service projects. [Note: Always reference the online version, which is updated quarterly.]
- **[ 7.0.3.1 ] — The Buddy System and Certifying Completion**  
Youth members must not meet one-on-one with adults. Sessions with counselors must take place where others can view the interaction, or the Scout must have a buddy: a friend, parent, guardian, brother, sister, or other relative —or better yet, another Scout working on the same badge— along with him attending the session. When the Scout meets with the counselor, he should bring any required projects. If these cannot be transported, he should present evidence, such as photographs or adult certification. His unit leader, for example, might state that a satisfactory bridge or tower has been built for the Pioneering merit badge, or that meals were prepared for Cooking. If there are questions that requirements were met, a counselor may confirm with adults involved. Once satisfied, the counselor signs the blue card using the date upon which the Scout completed the requirements, or in the case of partials, initials the individual requirements passed.
- **[ 7.0.3.2 ] — Group Instruction**  
It is acceptable—and sometimes desirable—for merit badges to be taught in group settings. This often occurs at camp and merit badge midways or similar events. Interactive group discussions can support learning. The method can also be attractive to “guest experts” assisting registered and approved counselors. Slide shows, skits, demonstrations, panels, and various other techniques can also be employed, but as any teacher can attest, not everyone will learn all the material.  
  
There must be attention to each individual’s projects and his fulfillment of *all* requirements. We must know that every Scout — actually and *personally*— completed them. If, for example, a requirement uses words like “show,” “demonstrate,” or “discuss,” then every Scout must do that. It is unacceptable to award badges on the basis of sitting in classrooms *watching* demonstrations, or remaining silent during discussions. Because of the importance of individual attention in the merit badge plan, group instruction should be limited to those scenarios where the benefits are compelling.
- **[ 7.0.3.3 ] — Partial Completions**  
Scouts need not pass all requirements with one counselor. The Application for Merit Badge has a place to record what has been finished — a “partial.” In the center section on the reverse of the blue card, the counselor initials for each requirement passed. In the case of a partial completion, he or she does not retain the counselor’s portion of the card. A subsequent counselor may choose not to accept partial work, but this should be rare. A Scout, if he believes he is being treated unfairly, may work with his Scoutmaster to find another counselor. An example for the use of a signed partial would be to take it to camp as proof of prerequisites. Partial completions have no expiration except the 18th birthday.