BOY SCOUTS ENGINEERING MERIT BADGE

ART. HISTORY. CULTURE. AMERICA.

HARLEY-DAVIDSON MUSEUM

Merit Badge Requirements and Information

The Engineering Merit Badge requirements listed below are the ones that are required by the Boy Scouts of America. Some of the options offered in the Boy Scout Merit Badge requirements are not offered through the Harley-Davidson Museum®. Before coming to the Museum to complete the merit badge requirements, you must read the Engineering Merit Badge book. To be eligible for an Engineering Merit Badge, you must complete all of the requirements as outlined in this book.

To earn the Engineering Merit Badge you must complete the following requirements:

1. Investigate how and why a manufactured item works. (This requirement may be done at home or at the Harley-Davidson Museum.)
2. Learn about the engineering of motorcycles and how the motorcycle has influenced the world today.
3. Understand the work of six different types of engineers. Explain how their work is related.
4. Learn about what engineers do at Harley-Davidson through the Rocker Motorcycle project.
5. Make an original design for handlebar controls on a motorcycle.
6. Understand that in a four stroke engine, energy is converted from a gas-fuel mixture to a power stroke.
7. Explain what it means to be a registered Professional Engineer.
8. Explain how the Engineer's Code of Ethics is like the Scout Oath and the Scout Law.
9. Learn about three engineering careers and the education, training and experience needed to pursue that type of career.

Helpful Reminders:

1. Read the Engineering Merit Badge book before visiting the Museum.
2. Bring this booklet, a piece of drawing paper, and a pencil with you when you come to the Harley-Davidson Museum.
3. Additional copies of this booklet and additional Scout Leader references can be downloaded at *www.h-dmuseum.com*

Requirement 1

Select a manufactured item in your home (such as a toy or an appliance), and under adult supervision investigate how and why it works as it does. OR View the engine videos in the Engine Room which demonstrate how all of the parts of an engine work together. Answer the questions below.

What sort of engineering activities were needed to create the object?

In the space below, list three observations you made while taking apart the object or viewing the engine videos.

Share what you learned with your counselor.

REQUIREMENT COMPLETED

Requirement 2

Motorcycles are an engineering achievement that has had a major impact on society. Visit the historical galleries on the second floor and answer the following questions.

- **What are the names of the four founding fathers that started the Harley-Davidson Motor Company?**

- **Which founding father was the chief engineer?**

- **Look around the historical galleries. What were some of the challenges that the founding fathers had to overcome in the first 30 years of the Motor Company?**

- **How has the Harley-Davidson motorcycle influenced the world since the company began?**

REQUIREMENT COMPLETED

Requirement 3

Match the engineers below to the work that they do.

_____ Civil engineers	1. Develop useful things based on the newest advances in chemistry.
_____ Mechanical engineers	2. Design food farm and food processing equipment and develop systems for irrigation, drainage, and waste disposal.
_____ Chemical engineers	3. Apply the principles of physics to design, build and maintain mechanical systems.
_____ Bioengineers	4. Meet society's need for infrastructure—like roads, railways, bridges, dams, etc.
_____ Computer engineers	5. Find ways to make memory storage devices smaller, to fit more circuits on a microchip, and to move data faster and faster through the circuits.
_____ Agriculture engineers	6. Combine biology and engineering to study the mechanics of living organisms, often working with medical doctors.

Pick two different types of engineers and in the space below tell how their work is related.

REQUIREMENT COMPLETED

Requirement 4

In the Design Lab, watch the videos playing in the kiosks. Follow the design of the RUSHMORE motorcycles by listening to the engineers describe their work on the project.

Describe the type of work this engineer does.

Describe some of the tools this engineer uses to do his work.

Describe Project RUSHMORE.

Describe the engineer's particular role on the project.

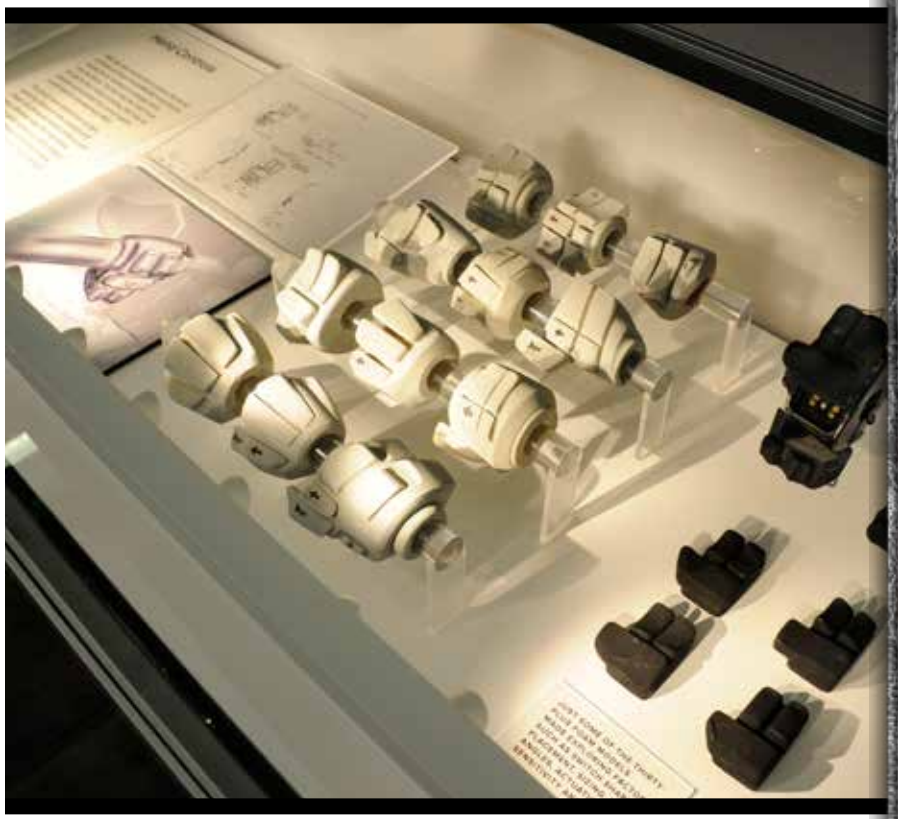
Describe the results the engineer achieved on the project.

Write two things you learned about engineering.

REQUIREMENT COMPLETED

Requirement 5

Visit the Design Lab in the Museum. Study the sketches for the design of the handlebar controls. On a separate sheet of paper, make an original design for a piece of patrol equipment. Use the systems engineering approach to help you decide how it should work and look.



In the space below explain why you designed it the way you did and how you would make it.

REQUIREMENT COMPLETED

Requirement 6

The Four Stroke Engine (Converting Energy)

Visit the Engine Room and the "How It Works" display. List the four strokes in the engine cycle and fill in the blanks.

_____ The flywheel draws the piston downward, allowing an atomized mixture of _____ and _____ into the enclosed cylinder.

_____ The intake valve closes. The piston climbs _____and compresses the air-fuel mixture.

_____ The piston reaches the top, the spark plug fires and the compressed air-fuel mixture _____. As the mixture burns, it expands, and thrusts the piston downward again.

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Requirement 6 (Cont'd)

_____ The piston moves up the cylinder and the exhaust valve opens pushing the _____out and the process starts all over again.

REQUIREMENT COMPLETED

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Requirement 7, 8 and 9

Find a quiet space in the Harley-Davidson Museum and answer the following questions.

What does in mean to be a registered Professional Engineer (P.E.)?

You have read the Engineer's Code of Ethics. How is this code like the Scout Oath and Scout Law?

List three different careers in engineering

Choose one career and describe the type of education, training and experience required for this profession.

REQUIREMENT COMPLETED

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