The Home Front: Tin Can Do It!

10 Years of Robotics at The National WWII Museum

2023 Robotics Challenge



"We are now in the war. We are all in it all the way. Every single man, woman and child is a partner in the most tremendous undertaking of our American history."

– Franklin D. Roosevelt, December 9th, 1941

When we think of World War II, the first images that enter our minds usually involve battle: armies fighting their desperate struggles on land, huge navies patrolling the oceans, and aircraft soaring sleekly overhead. All of these stirring images are accurate, of course, and yet they are also incomplete. Consider this: A total of 16 million Americans donned the country's uniform in the course of the war, out of a total US population of 132 million (according to the 1940 Census).

An impressive number, to be sure! But what of the other 116 million Americans, the ones who remained behind? They played a crucial role in the fight, and their story, too, deserves to be told. Global war placed great demands on the American people, requiring a level of involvement, commitment, and sacrifice unknown in previous conflicts. Without the steadfast support of the "Home Front"—the factory churning out weapons, the mother feeding her family while carefully monitoring her ration book, the child collecting scrap metal for the war effort—US soldiers, sailors, and airmen could not have fought and defeated the Axis powers of Germany, Japan and Italy. America and its Allies did win World War II on the battlefields of Normandy, Iwo Jima, and Midway. However, those victories owed a great deal to the factories of Pittsburgh, Cleveland, Detroit, and New Orleans, and to the dedication of ordinary Americans across the country.

Follow this link to watch the 2023 Robotics Challenge Introduction Video: https://youtu.be/KrEqID4RUOQ

Robotics Competition Mission Objectives

Headquarters

Your robot can only launch from the Headquarters area, but it can return anywhere in the Headquarters and base area. Headquarters and base are the only two area you may touch your robot during competition without receiving a touch penalty.



Tin Can Do It: Scrapping on the Homefront

One way Americans showed support for the war effort was by salvaging materials needed for military use. The "Salvage For Victory" campaign was launched in 1942 in order to encourage Americans to conserve and collect valuable materials including metal, paper, and rubber. These materials were important for the military and the Home Front, where supplies were in high demand. For example, tin could be melted down and reused in building aircraft, but it was also needed for canning food.

In addition to collecting valuable materials, the "Salvage For Victory" campaign was important for engaging the American public in the war effort. In a time when many were doing without, it was important to remind the community that this was not for nothing. The "Salvage For Victory" campaign made everyday citizens feel like their experiences and hard work were important to the outcome of the War.

The term "salvage" is not used now as much as it was in the 1940's. Now, we use terms like "recycle" when we talk about saving materials to repurpose them later. Our goals have also changed since World War II. For example, instead of saving scrap metal so that it can be made into aircraft, we recycle so that it can be reused instead of ending up in a landfill with other waste.

In this mission, your robot will move the Mini Slinky from Headquarters to the white box inside of the "Save Scrap for Victory" poster. At the end of the match, if the slinky is completely inside of the white box on the poster (not touching the edges), your team will receive 20 points. If the slinky is touching the white box, you will receive 10 points. If it is touching the poster but not the white box, you will receive 5 points.







Victory Gardening

One of the government's efforts to make sure that there was enough food for everyone — civilian and military alike — was the campaign for Victory Gardens. The idea was that everyone could raise some fruit or vegetables. They were a way for people to feel patriotic and contribute to the war effort. There were almost two million Victory Gardens in the United States during the war, planted everywhere from suburban backyards to small city plots of land.

Victory gardening was strongly encouraged in messaging from the U.S. government, and Americans worked together to share tips and make their gardens as successful as possible. Books like *Garden for Victory* by Jean-Marie Putnam and Lloyd C. Cosper also shared helpful tips. One example was replacing flowering bulbs like tulips with root vegetables. Another was to find space for soybeans, which were a good source of protein when meat was not available. By 1943, victory gardens provided 40 percent of the produce in the United States. These gardens, and the food they produced, was valuable in making sure Americans had enough rations to last through the War.

For this mission your robot will collect vegetables from the mat and place them in the nearby basket. If one vegetable is in the basket at the end of the match, your team will receive 10 points. If two vegetables are in the basket, you will receive 20 points. If three vegetables are in the basket, you will receive 30 points. If all four of the vegetables are in the basket at the end of the match, your team will receive 40 points. If there are no vegetables in the basket at the end of the match, but one or more of them are in Headquarters, your team will receive 5 points.

*Note: The basket does not need to remain in one place throughout the match. However, the basket must be upright at the end of the match for points to be awarded for this mission. This means that the basket cannot be on its side or upside down at the end of the mission.



Manufacturing for Victory

The Allies' victory would not have been possible without the manufacturing that took place on the American Home Front. A shared sense of patriotism motivated factory workers to produce vehicles, ammunition, and many other necessities faster than ever before during World War II. In New Orleans, Higgins Industries produced over 20,000 boats by the end of the War, the most famous of which was the Higgins Landing Craft Vehicle and Personnel (LCVP), also known as the "Higgins Boat." Throughout Higgins Industries, motivational slogans like "The Guy Who Relaxes is Helping the Axis" reminded workers of the importance of their labor.

Andrew Higgins modelled the Higgins boat after those used in Louisiana's swamps and marshes, which made them perfect for landing near beaches. President Eisenhower later said, "[Andrew Higgins] is the man who won the war for us. If Higgins had not designed and built those landing craft, we never would have landed over an open beach. The whole strategy of the war would have been different." Andrew Higgins's designs and the tireless efforts of the men and women at Higgins Industries were major in the result of World War II.

Your robot will move the three boats from the Higgins Factory to the river. To receive points for moving a boat, it must be completely in the blue area of the river, and not touching the land on either side. If one boat is completely in the river at the end of the match, you will receive 10 points. If two boats are in the river, you will receive 20 points. If all three boats are completely in the in the river, you will receive 30 points.







Invent New Materials

Before World War II most of the United States' rubber was sourced from rubber plantations in Southeast Asia. As the War progressed, Japanese forces took control of many of these rubber plantations, making it very difficult to get new natural rubber in the United States. As with other materials, Americans were encouraged to ration and salvage rubber in order to conserve rubber supplies on the Home Front and overseas.

Rubber was deemed a strategic material for its importance to the production of all kinds of military equipment, from circuit insulation to infantry footwear and tires. American scientists were asked to produce a synthetic, or man-made, alternative to natural rubber. The U.S government and private companies worked together to develop a method for producing synthetic rubber. Their success led to a large increase in synthetic rubber production over the course of the War. This changed the way rubber was made in the U.S. and still has an impact today, because synthetic rubber is now used in more than 70% of rubber production in the U.S.

The scientists that were developing synthetic rubber had to try a lot of different possibilities before making something the country needed. Trial and error is important when inventing something new, because it helps the inventor learn what does and does not work. One accidental outcome of this trial and error process was the invention of Silly Putty! Scientists combined boric acid and silicone oil, hoping it would result in a good man-made rubber. Instead, the product was bouncy, gooey, and stretchy. This meant that it would not be useful for building tires, but was perfect for selling as a children's toy!

For this mission, your robot will move the container of Silly Putty from Headquarters to the laboratory pictured on the map. If the silly putty is partially in the white box inside of the laboratory, your team will receive 10 points. If it is completely inside the white box, your team will receive 25 points.





Go to the Movies

One of the major news sources for Americans was the newsreels that played before movies in their local theaters. While newspapers and radio broadcasts were invaluable to accessing news about the war effort, motion picture newsreels were one of the only ways to see footage and images associated with the war. The government controlled the news that was reported and the way it was delivered in many circumstances, in order to carefully manage the perception of the War on the Home Front. Newsreels depicted combat footage, segments featuring leadership explaining military strategies, and inspiring stories of American bravery and success.

Your robot will move the red fabric that is covering the theater screen to expose the logo on the mat. The theater screen is divided into five sections. An increasing number of points can be earned by exposing more of these sections. A section must be completely visible in order to receive points. If section 1 is exposed, your team will receive 10 points. If sections 1 and 2 are exposed, you will receive 15 points. If sections 1 through 3 are exposed, you will receive 20 points. If sections 1 through 4 are exposed, you will receive 25 points. If sections 1 through 5 are exposed, you will receive 35 points. For section 5 to be completely visible, the black and white theater screen must be completely visible, with no fabric covering it.

*Note: The red fabric must stay attached to the mat throughout the match. If the fabric is not attached to the mat at the end of the match, no points will be awarded for this mission.







Women Go To Work

The manufacturing needs of World War II led to millions of women joining the workforce in positions they had never had access to before. A vast majority of the country's working age men were needed for the war effort, which created the requirement for more female presence in the workforce. Throughout the course of the war, it is estimated that 18 million women joined the defense and support industries in support of the war effort.

Rosie the Riveter became the symbol for women who worked in military production industries on the Home Front. During the war, women were encouraged to fill traditionally male positions as an act of patriotism. However, opinions shifted after the war, when many female workers were laid off from factory positions and their positions were given to returning servicemen. Still, the figure of Rosie the Riveter persists as a symbol of American feminism and female empowerment.

For this mission, your robot will move the plastic Rosie the Riveter figurine from Headquarters to the white box at the factory. At the end of the match if the figurine is on its side and touching the white box, your team will receive 10 points. If it is upright and touching the white box, your team will receive 20 points. If it is upright and completely inside the white box, your team will receive 30 points.

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Rationing

During the war, food was rationed because the troops had to be fed and most of the ships that carried goods were used for war supplies. People received ration books, which had coupons for certain items like sugar, coffee, butter, meats, and canned goods. The coupons allowed you to buy the item in the store. Even if you had the money, if you did not have a coupon, you could not buy that food!

Rationing meant everyone got a fair share when there weren't enough supplies. Besides food, clothing and gas were rationed too. Shoe rations were introduced in 1943 in order to limit leather usage. Americans were limited to up to three pairs of shoes each year, and could only buy new shoes in one of four set colors. Additionally, gas and rubber shortages forced many Americans to do less driving. That meant that many homes had to be careful of how many times they went to the movies, to visit family, or even to the store.

For this mission, your robot will deliver a ration stamp to the store and use it to "purchase" the M&Ms packet. Your robot will first bring the ration booklet from Headquarters to the store and deposit it in the plain white box. Once the ration booklet is at least partially in the bounds of the white box, your robot can take the M&Ms from the store, and bring them back to Headquarters. At the end of the match, if the ration booklet is successfully brought to the store and the M&Ms are brought to Headquarters, your team will receive 30 points. If the ration booklet is brought to the store but the M&Ms are not at headquarters, your team will receive 15 points. Your team will only receive points for this mission if the ration booklet is brought to the store. Points will not be rewarded if the M&Ms are retrieved without "purchasing" them with the ration booklet.





War Bonds

The massive increase in demand for both materials and manpower made World War II very expensive for the United States. The government turned to its citizens to fund the war effort by encouraging them to purchase War Savings Bonds. Americans could buy war bonds from the government for a set price and redeem them later for more money. For example, a Bond purchased for \$18.75 could be redeemed 10 years later for \$25. War Bonds were marketed as an investment in the military's success, as well as an investment in one's future finances.

War bonds were also purchased through war bond stamps, which cost as little as 10¢. The stamps were meant to be pasted into a war bond booklet and redeemed later for a greater price. The war bond stamps enabled smaller purchases over time, and were used to encourage children to do their part as well in raising money for the war.

For this mission, your robot will add a 10¢ stamp to the War Savings Bonds booklet by delivering a set of sticky notes to the booklet from headquarters. If the sticky notes are partially inside the lines of the white box, you will receive 10 points. If the sticky notes are completely inside the bounds of the white box, you will receive 25 points.







The Harvard Mark I and Binary Code

While a lot of military action was taking place overseas, intelligence operations and strategy were being developed on the Homefront. Navy Rear Admiral Grace Hopper worked under Howard H. Aiken as one of the first programmers of the Harvard Mark I computer, and went on to become one of the pioneers of computer coding. The Mark I was used to process calculations in the development of the Atomic Bomb. It was also known as the Automatic Sequence Controlled Calculator, which means it could process mathematical equations automatically according to the instructions it was fed.

The instructions for the Mark I, like all computers, had to be formatted in a certain way. This computer read its instructions from "punched paper tape," a long strip of paper with holes punched into it in the form of a code. The "code" in this case, was binary code, which uses combinations of 1 and 0 to represent numbers and letters. This code made it possible for long sets of instructions to be read by the Mark I, which could then make calculations for the mathematicians and programmers running it. Grace Hopper would go on to leave a lasting legacy in the world of computers and coding, creating coding languages that are still in use today and contributing to many advancements in computer technologies during her lifetime.

This mission has two parts. In the first, your robot will retrieve the cannister with a coded message from Grace Hopper and return it to HQ for 15 points. In the second, your teammates will decipher the coded message inside the cannister using the Binary Code key. If the message is correctly decoded by the end of the match, your team will receive 30 additional points.





Transport Aircraft to the Military Base

American production of aircraft increased dramatically during World War II as the United States worked to manufacture aircraft for multiple Allied forces. The Boeing Company was one of the most notable manufacturers, producing nearly 28% of the aircrafts manufactured by the United States. Boeing designed many valuable aircraft including the famous B17 Flying Fortress, which was used widely in the daylight strategic bombing campaign over Europe and in the Pacific War. Aircraft manufacturing was one of many industries that recruited female workers, with female employees representing more than 40% of The Boeing Company's workforce in 1944.

Women also made history flying military aircraft during World War II. One of the most famous examples of this were the Women Airforce Service Pilots (WASP). Although they flew military aircraft, WASPs were employed as civilian pilots. They were not allowed to fly in combat, so the primary duty of WASPs was ferrying planes across the United States. This meant that they were responsible for moving American aircraft to get them in place for military operations. The WASPs were essential to the success of the United States military because their service enabled more male pilots to join combat overseas. However, even though their training was almost identical to male pilot training and their jobs put them in consistent danger, WASPs were not considered service members until 1977. After years of fighting for recognition, WASPs were granted military status. Over 30 years later in 2009, President Obama signed a bill awarding the WASP the Congressional Gold Medal.

For this mission, your robot will transport the toy airplane from the factory to the runway. If part of the toy airplane is touching the white box at the end of the match, you will receive 15 points. If it is completely inside the white box, meaning all of the wheels are completely inside the white space, you will receive 25 points. The airplane must be upright (all four wheels touching the mat) to receive points for this mission.



Touch Penalties

When the robot is running on the game field, the less you touch the robot or interrupt it, the better. If you don't have to interrupt your robot during the match you will receive 10 points.

Benefit of the Doubt

Teams will receive the benefit of the doubt when it comes to mission objective points if there is any doubt to scoring in regards to the Robot Game.

Follow this link to watch the 2023 Robotics Challenge Introduction Video: https://youtu.be/KrEqID4RUOQ

Robotics Competition Rules

Teams must be registered online with The National WWII Museum to compete in the Robotics Challenge. Registered teams will receive the season's game mat and mission models by mail.

Teams must participate in both the Robot Game and the Engineering Project.

Teams will consist of a minimum of 2 and a maximum of 10 team members.

Team members must be in the 4th through 8th grade at the time of competition, unless provided with written approval from The National WWII Museum.

All work presented at the Robotics Challenge Competition must be by the team members; adults cannot take part in building or programming of the robot, or with the design and construction of the engineering project. Adults are not permitted to interact with a team's robot. This includes at competitions.

Only LEGO Mindstorms (any generation) or LEGO SPIKE Prime robots can be used for the competition.

Teams, coaches, volunteers, staff and spectators are expected to exhibit good sportsmanship throughout the competition season.

Consequences

Teams and individuals that fail to follow the Robotics Competition Rules may be ineligible for awards and/or advancement at a Robotics Competition.

Engineering Project: From SCRAPPING to RECYLING

Americans on the Home Front "Salvaged for Victory" to help win the war. From collecting used cooking grease to patching worn clothing, "Use it up, Wear it out, Make it do, or Do without" became a way of life. The lessons of WWII continue to be relevant to our lives today. What was once called "scrapping" is now called "recycling." We protect the environment and conserve Earth's limited natural resources by recycling waste, reducing energy and water usage, and making wise choices about the products that we buy. Every day, scientists and engineers are working to develop modern solutions to modern conservation issues. Likewise, everyday citizens become environmental stewards in their communities all the time, from collecting litter outdoors to planting pollinator gardens in their own backyards.

Your Team's Project

Imagine your team is a public relations company creating a campaign for a government agency to educate and excite the public about a conservation issue that impacts your community. Create the following two elements for your campaign: a poster with a catchy slogan and a short video. You choose the audience: your school, your city or state, or even the entire country. The PR firm that designs the most effective and exciting campaign will win the contract!

Make your campaign exciting and unique; consider going beyond encouraging people to collect recyclables in blue or green bins. Remember, conservation of resources can include reducing carbon dioxide emissions, buying fewer manufactured goods, shopping locally, and growing food in local gardens. The best ideas are often the simplest, but make sure your campaign suggests specific action steps that ordinary people can follow. Do some research about the needs in your community so that you can design your campaign in an informed way. See what other communities and organizations are doing. Your campaign should find inspiration in the propaganda posters that were seen on the Home Front during World War II.

The Poster

- Study the designs of the propaganda posters included on the robotics mat. Do some more research on WWII
 propaganda posters in the library or online. Consider the visual style, colors, symbols, and word choice the
 designers used to affect Americans to take action.
- Use your powers of persuasion to appeal to your audience.
- Include your slogan on the poster.
- Poster can be no larger than 24" x 36" but does not have to be rectangular.
- It can be a realistic depiction or an abstract representation, in color or black and white, you can use pencil, pen, crayons, markers, paint, or collage. It must be original, but you can incorporate existing images. No glitter, please!
- Mount your poster on firm backing (like foam core or cardboard) so that it can be displayed on Museum provided easels at the Challenge.

The Video

- Write, direct, and star in a video promoting your campaign to the public. The video can be anything from a commercial or video essay to a scripted sketch, but it should be clear in its connections to the PR campaign.
- Make your video interesting, exciting, informative, and suggest at least one action that people should take to accomplish your campaign's conservation goal.
- Videos are limited to a three-minute maximum (although yours may be shorter). Be sure to get to the point and hold the audience's attention.
- Save your video securely. Be prepared to submit it to <u>robotics@nationalww2museum.org</u> by Friday, May 5th in preparation for judging.
- Check the <u>http://www.nationalww2museum.org/robotics</u> for updates to the instructions for submitting your video.

Criteria for Judging and Important Dates

- Your project will be judged for its originality and effectiveness as a public relations campaign.
- Scientific accuracy, grammar, spelling, punctuation, and overall visual appeal are important components of the judges' decisions.
- Adhere to project size restrictions: poster size no larger than 24" x 36" and the video three minutes or less.
- Be prepared to submit your video to <u>robotics@nationalww2museum.org</u> by Friday, May 5th.
- Judging will take place at the National World War II Museum during the Robotics Challenge on Saturday, May 13th.
- Bring your poster to the Challenge for judging.
- Be prepared to answer questions about your project, including but not limited to:
 - Who was the audience of your PR campaign?
 - Why did you choose that audience?
 - How does the chosen conservation issue impact your community?