SUSTAINABLE TIRE INNOVATION
Cooper is involved in a variety of tire research and development (R&D) activities to improve tire performance, service and cost. Today, many initiatives focus on R&D to make tires more sustainable, such as designs that improve fuel economy by reducing tire weight and rolling resistance.

**COLLABORATION AND PARTNERSHIPS**

Cooper collaborates with a number of entities and partners, including those listed below, on tire raw materials and design, training, regulatory matters, scrap tire management and other sustainability topics.

- Agricultural Research Service (ARS) of the U.S. Department of Agriculture (USDA)
- American Chemical Society
- American Society for Testing and Materials
- Arizona State University (ASU)
- The British Tyre Manufacturers’ Association
- The Cámara Nacional de la Industria Hulera (The Mexico National Chamber of the Rubber Industry - CNIH)
- Center for Tire Research
- Cooperative Approved Tire List
- The European Tyre & Rubber Manufacturers’ Association
- Global Technical Regulations for Tires
- Harbin University of Science and Technology (Heilongjiang Province, China)
- Industrias Negromex S.A. de C.V.
- Industrial Research Institute
- The International Rubber Study Group
- International Standards Organization
- The International Tire Exhibition & Conference
- National Highway Traffic Safety Administration
- The Ohio State University (OSU)
- PanArdis
- PENRA (The Program of Excellence in Natural Rubber Alternatives)
- The (U.S.) Rubber Manufacturers Association (RMA)
- Society of Automotive Engineers
- The Tire and Rubber Association of Canada
- Tire Society
- The University of Arkansas
- University of Toronto
- U.S. Department of Energy
- The World Business Council on Sustainable Development (WBCSD)

**Specific projects include:**

- Cooper works with the U.S. tire industry through the RMA to develop industry standards and statistics, participate in legislative and regulatory developments, educate consumers on proper tire care and safety, and promote the responsible management of scrap tires, including developing markets that use recycled rubber.
- Cooper and the Mexico tire industry are partnering through the CNIH on developing a scrap tire management plan for Mexico.
- Cooper is a member of the WBCSD, and participates in the Tire Industry Project to identify and address the potential health and environmental impacts of materials associated with tire making and use. While work on the project continues, the project currently focuses on:
  - Understanding the properties, fate and impacts of particles generated by the interaction between tires and pavements during tire use
  - Safely developing and using nanomaterials in tires
  - Working to encourage effective scrap tire management

A summary of the WBCSD work can be found at [www.wbcsd.org/work-program/sector-projects/tires.aspx](http://www.wbcsd.org/work-program/sector-projects/tires.aspx).

Cooper and our public and private sector partners have received several grants over the past few years for research to develop more sustainable tires and rubber sources. This research was ongoing in 2013, see pages 20–21 for details.
RESEARCH AND DEVELOPMENT

Our Approach

Cooper directs its research activities toward product development, performance and operating efficiency. We conduct extensive testing of current tire lines, as well as new concepts in tire design, construction and materials. During 2013, approximately 81 million miles of tests were performed on indoor test wheels and in monitored road tests. Additionally, Cooper continues to design and develop specialized equipment to fit the precise needs of its manufacturing and quality control requirements. Research and development expenditures were $44.6 million, $50.8 million and $51.1 million during 2011, 2012 and 2013, respectively. Cooper is raising our commitment to R&D, a trend that is also reflected in new and expanded facilities.

The Asia Technical Center was recently relocated from Shanghai to a new, purpose-built facility on the grounds of Cooper’s tire plant in Kunshan, China. This new technical center was constructed specifically for Cooper’s R&D activities and to house a staff of 65 material scientists and tire engineers. It features state-of-the-art testing equipment and expanded R&D capabilities focused on designing and developing new passenger and truck tires primarily for China and the Asia market.

Additionally, a new Global Technical Center (GTC) is being established in Findlay. This will be a center of excellence for tire science and technology, advanced technology and innovation technology, which will ultimately employ 40 scientists and engineers, many of whom will be in highly specialized technical roles. The GTC will have a dedicated R&D team focused on exploring such areas as nanotechnology and new polymers and compounds as well as reinforcements.

During a recent event, Cooper Chairman, Chief Executive Officer and President Roy Armes said, “Technology and innovation are critical in the tire industry. Technology drives the development of new products that deliver improved performance, environmental advantages and safety benefits for today’s drivers. At Cooper, we’ve seen how new products that resonate with our dealers and consumers can give our company a competitive advantage, and with the GTC, we are building on our already strong capabilities to pursue the newest technologies to drive our business—and perhaps the tire industry as a whole—into the future.” Sr. Vice President, Global Research and Development, Chuck Yurkovich explained, “Our focus is on developing ‘ready-to-use’ advanced technologies that help us expedite the product development cycle and allow Cooper to create innovations in Findlay and deploy them to meet regional customer and market needs around the world. We are able to develop and launch world-class products more rapidly each year, while continuing to emphasize enhanced tire performance, lightweight tire materials, rolling resistance and fuel economy, wet and dry grip, and reduced tire and vehicle noise. The GTC will help Cooper and its subsidiaries around the world stay ahead of the curve in a very competitive tire industry.”
Current Research Examples

Guayule Research Yields Concept Tire
Cooper is partnering with PanAridus, ASU and the ARS to conduct research on developing the guayule (pronounced why-YOU-lee) plant as an alternative rubber source. This research is funded by a $6.9 million Biomass Research and Development Initiative (BRDI) grant from the USDA. The grant focuses on research to develop enhanced manufacturing processes needed to produce guayule solid rubber as a biomaterial for tire applications, as well as evaluating the plant’s residual biomass for biofuel applications.

Guayule is a desert shrub, which grows in Mexico and the southwestern United States. It is one of the few plants containing sufficient rubber to exploit commercially. The rubber is very similar to conventional natural rubber that is used in nearly all tire lines. The aim is to use biopolymers extracted from guayule as a replacement for petroleum-based synthetic rubber and tropical-based natural rubber compounds used in the manufacture of tires.

Cooper’s engineers have made major strides in developing all-guayule compounds for a concept tire, and have successfully built a tire with two separate components based on 100 percent guayule rubber. Ultimately, we plan to have a concept tire for testing with 100 percent of the natural and synthetic rubber replaced by guayule-based rubber.

Part of the grant deals with the environmental, economic and social impact of guayule agriculture and rubber production on communities. Recently, ASU issued the first thesis based on the BRDI grant for which a framework for modeling the environmental impact was developed. It emphasizes the importance of utilizing all of the by-products from guayule in a sustainable manner to minimize the overall effect on the environment.

COOPER’S APPROACH IS TO EXPEDITE DEVELOPMENT OF ‘READY-TO-USE’ ADVANCED TECHNOLOGIES AND DEPLOY THEM TO MEET REGIONAL CUSTOMER AND MARKET NEEDS AROUND THE WORLD.
Gas-Saving Prototype Fuel-Efficient Tires
The U.S. Department of Energy’s (DOE) Office of Energy Efficiency and Renewable Energy awarded Cooper $1.5 million to develop advanced fuel efficiency technologies. The grant was one of only five awarded by the DOE in the Fleet Efficiency category. Our goal is to develop an ultra-lightweight prototype tire that delivers a minimum of 3 percent improvement in vehicle fuel efficiency while lowering overall tire weight by a minimum of 20 percent. This funding is being used to accelerate innovative tire design, construction, materials and reinforcement technologies focused on the replacement tire market.

To achieve our goal, Cooper has been exploring six new technologies during Phase I of the project from 2011 through 2013. During 2014, Phase II of this program will explore the holistic impact of putting all these technologies together in a new low-weight tire profile design. At the end of Phase II, Cooper will have created and tested a prototype of a fuel-efficient tire and be able to use these newly developed technologies in existing and future product lines. Cooper intends to possess superior fuel efficiency technology as a result of the technological developments from this project, and it is our intent to contribute to our country's vision of becoming more energy independent.

Study Targets Potential New Domestic Rubber Source
Cooper also partnered with PENRA to study the Russian dandelion as a possible domestic source of natural rubber. There is potential for natural rubber to be extracted from the plant and used in polymer compounds for multiple tire components. Russian dandelions have traditionally required little fertilizer or water, and the Ohio State University’s Ohio Agricultural Research and Development Center (OARDC) estimates farmers would make a greater profit per acre by growing the dandelion for rubber production than growing more traditional crops. OARDC and the Ohio BioProducts Innovation Center, along with other university and industry partners, were awarded a $3 million grant to develop a renewable, domestic source of natural rubber. Cooper received a small quantity of this rubber, and preliminary lab tests indicate that this material has the potential to be used as a replacement for conventional natural rubber. Cooper and OSU are now in the program planning process, which is setting milestones as far out as 2020.
SUSTAINABLE TIRE INNOVATION

SUSTAINABLE PRODUCT ADVANCES

CS5 Luxury Touring Tire Improves Fuel Mileage and Helps Drivers Assess Tread Wear

Cooper developed the CS5 Touring tire, which features an improved, second-generation silica tread compound with an advanced polymer formulation that has up to four times more silica than the previous generation of premium all-season tires. This new tread compound dramatically increases tire performance and, when combined with other advanced tire technologies, lowers rolling resistance, improving fuel mileage. The CS5 is one of the lightest tires in its class, which also translates to increased fuel efficiency. The tire also incorporates the new Wear Square™.

Consumers gain an innovative safety feature with the Wear Square™ to help them gauge the amount of wear on their tires, providing an indication of when it may be time to replace them. The Wear Square is exclusive to Cooper and features a visual indicator that is part of the tread design and allows drivers to quickly assess the approximate tread life remaining on their tires, giving them more confidence on the road. As the tire wears, the Wear Square transitions among five stages, beginning with a full square design on new tires and ending with an exclamation mark when the tread reaches 2/32s of an inch, which indicates that it is time to replace the tire. Located at three points of reference around the inside and outside of the tire, the Wear Square can also signal uneven tire wear and possible wheel alignment issues.