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Our aim is to show you what happened when the WRO® family met at the annual finals in Costa Rica last year and to look ahead to the tournament in Thailand. We also want to tell you more about life in our organization.

WRO was started to promote robotics to young people all around the world. By learning more about robotics, we hope young people will become interested in what we call the STEM subjects - science, technology, engineering and math.

It would be great to inspire the innovators of tomorrow, but at WRO our main aim is to build a love of learning and enquiry. Our teams learn more about themselves, about each other and the world beyond them.

This year sees our organization becoming bigger and more diverse than ever before. It means that more people are able to experience the excitement and challenge of robotics, no matter where they are in the world, and enjoy what WRO has to offer.

We look forward to seeing you at a WRO event soon.

Claus Dittev Christensen
WRO Secretary General

Welcome to this year’s annual report
Big numbers 2017

Season worldwide

- Over 23,000 teams worldwide
- Over 25,000 adult volunteers* involved (coaches, judges etc)
- Over 60 active countries

International Final

- 392 teams visited the international final
- Volunteer judges came from 29 countries
- Over 2000 people* traveled to Costa Rica for the event (coaches, teams, judges, parents)

Participating in WRO®
Not participating in WRO
World Robot Olympiad™ was set up in 2004. Its mission statement said it aimed to “…bring together young people all over the world to develop their creativity, design and problem solving skills through challenging and educational robot competitions and activities…”

Today, we are a large, diverse, multinational family, all dedicated to our task of making young people excited about robotics and the challenges of the future.

We have over 60,000 young people in 23,000 teams from over 60 countries. Organizing them and making sure that everyone gets to experience the WRO values such as cooperation, fun and a sense of adventure is no easy task.

This is why each country has a national organizer. They can be non-profit organizations, universities, educational organizations and companies who have shown that they have an interest in robotics and educating future generations.

Without these organizations and the countless volunteers in all our member countries, there would not be a World Robot Olympiad.
The Advisory Council

We are advised by a team of experts who help set our agenda and strategic direction, making WRO® the success that it is

WRO consists of a series of national organizers who are responsible for all the robot-related activities in their country. The job of deciding what those activities are is the job of the Advisory Council, or ‘AC’.

The Advisory Council consists of a number of experts in the robotics field, from companies, universities and national organizers. Their task is to make sure WRO keeps being a relevant competition. They also advise on the selection of host countries for the International Final.

The AC can install temporary and fixed panels to advise about relevant topics. Two fixed panels report about the games & rules for each year’s competition as well as the judging process. The Board of Directors makes all final decisions about WRO. In addition to the Board, the Council and the panels, we also have a small but dedicated team of permanent staff whose job is to see to the day-to-day running of the organization.

The Board of Directors

Governing WRO®, making financial decisions as well as determining the strategy, the WRO Board of Directors consists of:

Mr Lars Vahl (Chairman)  
Ms Leefin Cham (Finance Manager)  
Mr Claus Ditlev Christensen (Secretary General)  
Mr Eugene Zhang  
Mr Johnson Jan  
Mr Yasuhide Kobayashi  
Mr Clarence Sirisena

The Advisory Council

Known as ‘the AC’ to WRO experts, this body includes experienced academics and senior figures from the corporate world. Their expertise keeps WRO relevant and up-to-date with rapidly evolving technology and makes sure the challenges relate to real-world problems.

The chairman of the AC is Mr KingHui Law from Malaysia. He is assisted by:

Mr Eugene Zhang, China  
Dr Feng-Kuang Chiang, China  
Mr Johnson Jan, Chinese Taipei  
Dr Kai-Ta Song, Chinese Taipei  
Mr Yasuhide Kobayashi, Japan  
Dr Norikana Kanai, Japan  
Mr Clarence Sirisena, Singapore  
Dr Marcelo Ang, Singapore  
Mr Lars Vahl, Denmark  
Mr Ole Caprani, Denmark  
Dr Najla Mohammed, UAE  
Mr Kerry Bailey, UAE  
Mr Brent Hutchesson, South Africa  
Mr Dominic Bruneau, Canada

The Panels

We have two panels who are concerned with the running of our events. They make sure that the judging is fair and transparent and that the judges are highly qualified.

Games and Rules Review Panel

This is led by Ole Caprani, Associate Professor at the Department of Computer Science at Aarhus University. Ole runs a ‘LEGO Lab’ at the University. He is assisted by Alexander Kolotov from Innopolis University in Russia where he is active in various STEM activities.

Judging Panel

The main responsibility of the Judging Panel is to make sure everyone who judges at our international final is highly qualified and experienced. It is run by Brent Hutchesson who owns Hands on Robotics in South Africa, where he has been a key figure in introducing robotics competitions to the townships.
Science, technology, engineering and math all have their part to play in giving WRO® its relevance in the modern world

How do you promote the STEM subjects?

Our answer at WRO is that we promote them using robotics with a series of challenges that are designed to get our teams working and thinking together. Using creativity, inventiveness and a methodical approach to problems they learn that they can develop the skills they need to tackle any situation.

But what people find most interesting is that each year the different challenges take a real-world problem as their focus. From finding sustainable solutions for climate change and protecting biodiversity to inventing methods for precision farming and preventing food waste, everything we do can be related to the life that our teams know.

How would you design a robot that helps ensure access to affordable and sustainable energy? Our teams found many different ways to do it. And when they worked on this problem, they would have realized why the United Nations say that energy is central to nearly every major challenge and opportunity that the world faces today.

Our events this year all involve encouraging teams to think about how we grow, share and consume food. That will also get them to think about what we eat, how it is grown and how that process affects the world around us.

Just like last year, the common ground here is sustainability. The themes make an appearance on the list of the United Nations’ Development Goals. By tackling these problems, everyone can help to make a difference, whether we are scientists and engineers working on today’s answers, or young people working on their robots and finding tomorrow’s.

In this way, WRO is just a small part of the overall picture. What it teaches us, the adults who help run the robotics events, is that the STEM subjects, like life, get better when we all work together.
WRO® categories

With more competitions and more challenges, there are more ways to sample the excitement of WRO than ever

The 2017 season saw us with six categories. There were the four main events that our teams and volunteers have come to love, as well as two new additions in the shape of WRO Future Innovators and WeDo. There is also Virtual WRO, which uses Cogmation’s Virtual Robotics Toolkit to extend robotics who people who might not be able to get to their nearest competition.

Rules for the Open and Regular Category are set in cooperation with the country named as the hosts of each year’s event. The rules and challenges for the other events are set by WRO’s team of expert advisors to challenge teams and keep each competition fresh and exciting.

All of our events have the same ideas behind them: a love of robotics, an embrace of the STEM subjects and an enjoyment of teamwork and fun. Whatever our teams achieve, from winning their categories to learning more about themselves and each other, we want to show that learning is exciting and enjoyable.

Regular Category

The Regular Category is a challenge-based competition. Students must design, construct and program their robots to solve specific challenges on a field. Points are scored for completed tasks. There are three age classifications: elementary, (age 12 and under), junior, (age 13-15) and senior, (age 16-19). Teams can have two to three people under the guidance of an adult coach.

Open Category

With the same three age classifications as the Regular Category, and the same team sizes, the Open Category relies much more on teams’ imagination and ability to present their ideas before an audience. Everyone has access to a 2x2x2 meter booth in which they have to present their research and a robot model in response to the year’s challenge. Teams are encouraged to come up with creative, unusual responses which show how robotics can be used to solve a particular problem.

WRO Football

This is open to participants aged between 10 and 19. Teams should be between two and three members. Each football team must consist of two autonomous robots and although there are small changes to the rules each year, the aim is always to score more goals than the opposing team. Robots must be reassembled on the day of the competition.

Advanced Robotics Challenge

Designed for students aged 17 to 25, this category is designed to give students’ engineering and programming skills the ultimate test.

In 2015 and 2016 there was a bowling competition and in 2017 a Tetristack challenge which saw the robots compete to sort and then slot blocks into a stack. The rules change according to advice from WRO® experts to provide a challenge and create a test of each team’s skills and ingenuity.

WRO Future Innovators

First run as a pilot project in Costa Rica in 2017, this saw seven Open Category teams of entrepreneurs from around the world presenting business ideas linked to their Open Category projects. The pilot helped the organizers and experts at WRO understand the subject more and will be run again in 2018.

You can read more about WRO Future Innovators on page 21.

WeDo

Another pilot that was run in 2017 saw the introduction of challenges aimed at younger children up to the age of 10, extending WRO-themed learning and fun even further. The challenges are based on the Regular Category and the Open Category format. While the WeDo category will not be judged at the International Final in 2018, national organizers are encouraged to run WeDo competitions in their country.

You can read more about WeDo on page 19.

Virtual WRO

This has been designed to allow national organizers to extend their reach. Developed in partnership with Cogmation Robotics, it allows people without access to a robot to build one in a virtual environment using LEGO® Mindstorms® EV3 technology. They can then compete against teams online or just interact with and perfect their robot.

Find out more at www.virtualrobotgames.com
On the way to its fourteenth birthday, WRO now has over 60 member countries and 23,000 teams, meaning that over 60,000 young people have access to our activities, a total that is growing all the time.

When preparing for WRO 2017 in Costa Rica, big parts of Central America were affected by tropical storms and hurricanes. Areas of Costa Rica were hit hard by the storm only weeks before the competition, and for the first time we were actually worried about being able to continue with the event. Fortunately, the San Jose area was not affected badly, and most logistical problems in the country were quickly solved.

The storms also had a big effect on two of our newest members, Puerto Rico and Cuba, causing so much devastation that it was almost impossible to continue with organizing a WRO competition. Both organizations are very determined and will be ready for the coming seasons.

Hosting the International Final in Costa Rica allowed more nations than ever before to see what WRO has to offer. We were pleased to welcome Ecuador, El Salvador, Honduras and Nicaragua from the Americas into our family, as well as Azerbaijan, Italy, Jordan, Macau and Morocco from further away.

Taking the Final to Costa Rica at all was an important step for WRO. “I met our Secretary General, Claus Ditlev Christensen Claus in Malaysia in 2012 and told him that WRO should be hosted in Central America,” remembers Alejandra Sanchez Calvo of Aprender Haciendo, our partner organization in Costa Rica. “Maybe he thought I was crazy. But two years later, we got a different government, the Minister of Science liked the idea, she supported me and that’s where the story really starts.”

Aprender Haciendo took their hosting role seriously. They shared WRO’s concern that they should promote the competition across the region and worked directly with Panama, Honduras, Nicaragua, El Salvador and Puerto Rico. “Those countries visited our national events and we received them with teams, judges and local authorities to learn about the development of national events,” Alejandra explains. “And we accompanied them in their first local events.”

When WRO arrived in Costa Rica, it had had already been well promoted through social media, radio and TV. This was so successful that even a month before the event, the workshops were already booked up. On the first Friday of the event, 2,500 students were there for the workshops as well as the exhibitions and around 10,000 people visited the international final.

Leaving our traditional home of Asia and the Middle East has helped us grow in the Americas and rewarded Costa Rica for so much hard work and self-belief. This year, we return to Asia, and will visit Thailand for the International Final.

As we go into our fifteenth year, bigger and more ambitious we believe there are real grounds for optimism. If you want to find out how to join our family by becoming a national organizer, turn to page 35. If you are already involved with WRO, thank you for your hard work in the past year and we hope to see you at an event in the near future.
At WRO®, we believe that it’s never too soon to be interested in robotics or the STEM subjects. This is why we are working with LEGO® Education to offer the WeDo programme in countries that already participate in WRO activities.

WeDo has been developed by LEGO® Education for children aged between six and 10. The aim is to give them a positive learning experience early in their lives by working with a less complex robotics system than the LEGO® Mindstorms® that still provides opportunities for learning and enquiry.

Even children with no previous interest in robotics or technical ability can get involved and learn the basics very quickly. WeDo has been designed so that everyone can have a go and, with that in mind, we decided to use it in a pilot program.

The pilot ran in younger versions of the Regular, Open and Football categories using rules designed by the Games and Rules Panel and by LEGO Education. Around ten countries took part and 85% of member countries surveyed also expressed an interest.

With that in mind, we used the feedback for 2018 and created official game rules for both the Regular and Open categories that any participating country is welcome to use. There will be no International Final in these categories this year as it will prove to be an extra challenge for the organizers, but we plan to keep this under review.

For the time being, we look forward to welcoming a whole new generation into the WRO family and look forward to seeing all their exciting new creations.
Future Innovators: the business perspective

Bridging the gap between robotics and business, Future Innovators hopes to find the next generation of leaders

We see hundreds of creative approaches to the problems of robotics every year. Some are ambitious, others are more careful evolutions of what has gone before. But what if teams who thought their idea could be the basis of a business could take it one step further?

This was the idea behind Future Innovators. Last year, we asked member countries who had a team which had qualified for the international final to join in with the pilot. They had to look at their project as a business and present a business plan (Business Model Canvas) to a panel of judges from major companies.

Seven teams took part in Costa Rica, meaning that we could monitor closely how well the competition worked. We were so pleased with their ideas, the way that they showed them to the judges and everyone’s enthusiasm that we decided to extend the pilot this year.

Ten teams will be competing in Thailand and, if the quality of the ideas we saw in Costa Rica is repeated, we look forward to seeing some truly innovative ideas.
When WRO travelled to Costa Rica last year for the International Final, it saw the tournament breaking new ground. It was the first time we have travelled to the Americas, far beyond our roots in South East Asia and an exciting opportunity to show the people in the region what WRO is all about.

Teams started arriving in the capital, San Jose, days before the competition was due to start on November 10. With local tour company Horizontes offering guided walks around the city as well as more adventurous trips to the Poas Volcano National Park or even chance to take a zip wire through the rainforest, everyone wanted to make the most of this lush and magical country.

But by Friday, almost everyone was in position and arrived at Parque Viva with its unique amphitheatre and exhibition hall, where the robotics events would take place. The venue was almost a summary of Costa Rica’s amazing journey itself, being set in 300,000 square metres of parkland that was once in frequent use as an auto racing track. The cars still visit occasionally, but this is a location that is all about experience and is being transformed into a small oasis of fun.

With that in mind, the teams might have been surprised that the exhibition hall had no air conditioning, but that is because Costa Rica has made sustainability its goal and keeping things cool the usual way uses too many resources. Instead, the venue was equipped with huge fans from the Big Ass Fan Company. And while the solution might have been as unusual as the name, it helped keep the competitors cool.

Once setup had been completed, it was on to the opening ceremony, attended by both the Vice President of Costa Rica, Ms Ana Helena Chacon, and the Costa Rican Vice Minister for Science, Technology and Telecommunications, Mr Sander Pacheco Arava, showing just how seriously the host country were taking the event.

All teams and guests saw a colorful welcome from Costa Rica with indigenous animals and live music helping to set the scene as well as sounds from the dense rainforests that cover much of the country. After that, WRO responded with delegations of one or two young people from each country taking to the stage with their national flag, some in national dress as well.
It made for a memorable night, but the real business of competition started the following day, with many members of the public coming to watch the roboteers assemble and test their robots ready for competition.

And there were sponsor exhibitions around the hall. International and national sponsors exhibited their technical and robot-related projects. Our friends at LEGO® Education had brought a huge pile of white bricks, which encouraged everyone to harness the WRO® spirit and get creative. Soon, cities and even elaborate sculptures were springing up, all connected to each other in one, giant sprawling WRO metropolis.

As well as the teams, busily reassembling and testing their robots, there were workshops where schools and other members of the public got to take their first steps in robotics or learn some new skills. It gave the international final a truly family feel as people of all ages were talking about robotics and, of course, seeing the teams compete.

The organizers varied the format so that all the teams in the Regular Category would compete over two days rather than one, prolonging their involvement and building the excitement. In the past, most teams were eliminated on day one, meaning that they may have flown halfway around the world for a few hours’ competition. Under the new rules, they could enjoy competing on Sunday too - and enjoy the Saturday night Friendship Party even more.

Formerly known as the Friendship Dinner, this received an injection of carnival excitement with different stands serving food from churros to cotton candy and even different activities. If teams wanted to find out what it was like to ride a rodeo bull or who was king of the hammer, this was the time. Most importantly there was danceable music, with people dressed as Mascaradas, or giant, papier-mâché headed figures in highly colored costumes, joining in. Before long, the whole WRO family was up and dancing.

The competitions resumed on Sunday with exciting closing matches. You can see the results on page 26. After the competition finished it was time for the closing ceremony. It was attended by the Minister of Science, Technology and Telecommunications, Ms Carolina Vasquez Soto. Before announcing the winners, all judges were called on stage to receive a standing ovation for all their hard work during the weekend.

When the winning teams had received their awards, it was time for another WRO tradition: handing over the official WRO flag to the next Host Country. It was presented to Mr. Krit Thanavanich, the Vice-Governor of Chiang Mai, who had taken the long trip from Thailand to Costa Rica for the occasion.

On Sunday evening most of the participants and coaches where relaxing or preparing for their trip home, but the National Organizers were invited to the annual WRO Appreciation Dinner. At this yearly event we celebrate all their hard work during the season.

There was a final postscript to our time in Costa Rica. It turned out that the event was so well promoted that everywhere in the country people had heard of it. This meant that teams traveling through the country after the event regularly met people such as bus drivers on country roads, or guides in the forest that actually had heard of WRO!
On this page you can find the winners of each category as well as the runners-up.

At WRO, we think it’s important to celebrate those teams, but it’s just as important to recognize everyone who took part. All the WRO challenges are designed to make people think creatively as well as to develop their skills and experience. That means that everyone wins when they engage with the challenges of robotics and the STEM disciplines.

By extending their knowledge, they are preparing themselves for a career in a related field or just learning more about themselves and how to grow their skills. And that is never wasted. So to the winners and the ones who took part, we say ‘congratulations,’ and you have our thanks for making this year’s WRO the most memorable yet.

See you next year.

WRO® 2017 results

From Builderbot to the Fixies, these are the teams who took the honors in Costa Rica and who thought up inspiring solutions to our challenges.
The next WRO International Final sees WRO returning to a country it has already visited. Thailand is home to vibrant colors and also exciting flavors and spices, making it an ideal destination, as our theme of the season will be on food.

One of the things that the Thai organizers said was that they have a rainy season and a dry season, so crops may rot or dry out in the fields. On top of that, people often order more than they can eat when they dine out, so the subject of food waste is of very real interest to the country’s emerging technology sector.

With technology in mind, the country has launched ‘Thailand 4.0 Industry’ to give its population the technical skills needed in the 21st century where automation is set to become increasingly important. And that is why they are happy to welcome WRO.

Bangkok might be the obvious choice, but instead we are heading for Chiang Mai. By working with the new Thai National Convention and Exposition Bureau, we learned more about this most authentic Thai city and realized that by heading away from the capital, we could promote robotics to a whole new audience.

Our host will be our Thailand National Organizer Gammaco, who supply science equipment for schools and universities across Thailand. The event is supported by the Thai government. The official agreement was signed by Assistant Professor Rawin Ravivong, the President of the National Science Museum which is connected to the Ministry of Science and Technology.

We look forward to meeting up with our new friends in Chiang Mai, as well as visiting all of our old friends in Thailand. It will be our pleasure to welcome you at WRO 2018 in Thailand.

In 2018, WRO goes back to south east Asia where it will visit old friends and hopefully make some new ones along the way.
Engineering Simplicity is the enduring philosophy of Juniper Networks, a leader in automated, scalable and secure networks. In the digital age, networks are the lifeblood of how the world lives, works and communicates – encompassing schools, hospitals, transportation systems, entertainment, internet connectivity, retailers, emergency services, banks and beyond, in every community, in every government and in every economy. Juniper believes that this intelligent, sophisticated, powerful technology can – must – also be simple to be effective, efficient and accessible.

Automation has become a key enabler of such technology, functioning alongside humans to create and operate networks that can scale, flex and protect, dynamically adapting to conditions, developments and challenges in nanoseconds. It is imperative that the upcoming generations understand automation – artificial intelligence, machine learning, virtualization – in order to take technology forward into their future. We are proud to be the global technology partner of World Robot Olympiad in 2018 and beyond, believing it to be the perfect nurturing environment for tomorrow’s automation innovators.

To learn more please visit: www.juniper.net

LEGO® Education is a long-time supporter and premium sponsor of WRO®, and LEGO® MINDSTORMS® has been used to grow instant STEM learning with high quality robotics solutions. The block-based programming platform of WeDo 2.0 is a natural first step towards the LEGO MINDSTORMS platform, which makes the new WRO WeDo competition format a great entry point into WRO for young students.

For more than 38 years, LEGO Education has been working with teachers and educational specialists to deliver hands-on learning experiences that bring subjects to life in the classroom and make learning fun and impactful. With a wide range of physical and digital educational resources that encourage students to think creatively, reason systematically and release their potential. The solutions for teaching and hands-on learning inspire science, technology, engineering, and math (STEM) for preschool, elementary and middle school students. All solutions are based on the LEGO system for playful learning and combined with curriculum-relevant material and digital resources.

An important part of the WRO International Final is the LEGO Education Creativity Award. The annual award recognizes the hard work and efforts of one team, regardless of category, that takes the most creative and imaginative approach to the design of their robotics solution.

“The addition of WeDo 2.0 is a great way for the younger age groups to enjoy the WRO experience, develop problem-solving skills and get excited about the STEM subjects.”

Esben Staerk Jørgensen, LEGO Education President

To learn more please visit: www.LEGOeducation.com
Meet the silver partners

Friends of WRO®
we work with these organizations in various ways, and are thankful for their support
- SAP, Germany
- TÜV Nord, Germany
- Innopolis University, Russia
- Hoopur, India

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National Instruments
Making software as well as hardware to help robotics students imagine and then build solutions to problems is just a small part of what National Instruments do. They also help professionals at over 30,000 companies around the world to design, prototype and then deploy technology which makes a difference to millions of lives, making them a natural choice for any organization that wants to turn robots that previously existed in students’ imaginations into reality.

Visit www.ni.com/academic to learn more about academic products and find curriculum resources

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TETRIX
The versatile TETRIX platform features the components used to make robots move, the aluminum elements used to give them a structure, and metal gears, as well as powerful and adaptable DC and servo motors. Their products also include the patented Hard Point Connector which allows TETRIX components to connect to the LEGO® Technic system, making TETRIX a valuable tool for people wanting to introduce an added dimension to their robots.

Take a look at www.TETRIXrobotics.com to find out more

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MATRIX Robotics
When a group of robotics enthusiasts get together to design their very own system, it ends up looking a lot like MATRIX Robotics. From the outset, it was designed to be an affordable, high-quality entry into 3D robotics. As a result, its various parts are accessible to our students and provide them with extra functionality and new ways of looking at their problems.

Go to www.matrixrobotics.com for more

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Virtual Robotics Toolkit
Cogmation Robotics produce The Virtual Robotics Toolkit, an imaginative way of helping students learn new robotics skills. By uploading their robot to a virtual, online world first, they get to see what works and what might need further development before testing in competition with other teams. With a realistic environment and vivid graphics, students can use new elements in new ways until the problem is solved and they can modify their robot.

Find out more at: www.virtualroboticstoolkit.com

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Find out more at: www.virtualroboticstoolkit.com
As a nonprofit organization, WRO is proud to be supported by leading technological companies and organizations that share our mission of bringing robotics to as many young people as possible. We aim to build close relationships with a limited number of companies and organizations. We will gladly engage in a dialogue with you on how your support can get maximum effect.

Supporter

Our Friends of WRO club gives you the opportunity to affiliate you, your company or organization with WRO. As a member, you help us support our national organizers and reach even more young people around the world. Joining our Friends of WRO club gives you the opportunity to promote your support of robotics competitions to your customers, relations and/or employees. You can become our friend by assisting us with concept development, donating time and resources or by supporting us with a financial contribution.

National Organizer

At World Robot Olympiad, our basic philosophy is to welcome all countries interested in joining our global community. The WRO program can be easily adapted to the specific situation in a country. We ask of our national organizers that they are capable of organizing the national competition independently. New national organizers get a one-year membership that can be converted into a membership for multiple years after a successful season. Apart from this, there are also numerous ways to support the WRO community at a national level. By volunteering as a coach or judge for example. Or by supporting the national organizer in your country.

Please visit our website for more information. www.wro-association.org