

## Chairman's Award - Team 4253

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2019 - Team 4253

### Team Number

4253

### Team Name, Corporate/University Sponsors

Taipei American School

### Briefly describe the impact of the *FIRST* program on team participants with special emphasis on the 2018/2019 year and the preceding two to five years

FIRST has opened doors for our team members. Many of our FRC alumni have found their place at some of the most prestigious STEM universities and colleges in the world such as MIT, Stanford, and Cornell, as well as careers in major technology companies (e.g. NASA, SpaceX, Microsoft, and Google), while continuing to contribute to the success of our team. Current team members find a home in FRC where they can develop their passion for robotics and hone important life skills for their future.

### Describe the impact of the *FIRST* program on your community with special emphasis on the 2018/2019 year and the preceding two to five years

Upon the birth of 4253, FIRST has taken root in our school and spread throughout the nation. Our school recently constructed the Tech Cube, providing students university-level facilities for pursuing robotics and engineering. The Taiwan government has acquired a full-time staff, set aside a generous budget, and started building a facility for FIRST in Taiwan. FIRST has transformed our community's overall approach toward education by shifting its focus from rigid academics to innovative learning.

### Team's innovative or creative method to spread the *FIRST* message

Team 4253 takes direct action in spreading FIRST. From local students to government ministers, we galvanize the community towards the FIRST mission by sharing our FRC experiences in both English and Chinese, online and face-to-face. Through STEM initiatives, we work in underrepresented communities and inspire students with innovative solutions to real-world problems. FRC training camps and direct collaboration with government agencies further ingrain the values of FIRST in a sustainable manner.

### Describe examples of how your team members act as role models and inspire other *FIRST* team members to emulate

Our team acts as role models both in the workshop and out, inspiring other FIRST members to use STEM learning to create an impact on the community. With a gender-balanced team, we inspire both boys and girls to become future STEM leaders. Through active commitment to FRC, we display our fervent passion for robotics and the opportunities it holds. Through grassroots projects in local communities, our team has demonstrated the bonds of FIRST and the benefits of STEM in creating a better future.

**Describe the team's initiatives to help start or form other FRC teams**

In 2016, we cold-called over 60 schools in Taiwan to spark interest in FIRST and started two teams: 6083 and 6191. We keep in consistent contact with rookie teams in Taiwan to ensure their sustainable future, generously providing valuable resources and expertise. In 2017, our team helped secure government funds for a FRC workshop for over 20 schools to kickstart new teams. Last summer, our veterans ran a 2-day intensive FRC camp, establishing the foundations of 22 new FRC teams in Taiwan.

**Describe the team's initiatives to help start or form other *FIRST* teams (including Jr.FLL, FLL, & FTC)**

As a driving force for FIRST in Taiwan and Southeast Asia, Team 4253 values the sustainable relationship it has with teams in the region and actively mentors other FIRST teams. For example, we went to robotics promotion centers to give FLL teams advice and invited FTC teams to visit our lab to learn our building and programming techniques. We also advise our middle school FLL team and are currently working with the school administration on a new course to mentor Lower School students in FLL.

**Describe the team's initiatives on assisting other *FIRST* teams (including Jr.FLL, FLL, FTC, & FRC) with progressing through the *FIRST* program**

For many teams in Taiwan, English communication and traveling abroad are daunting challenges. As such, we translate the competition rules and go over the logistics of signing up and traveling to competitions with the numerous teams we have helped start. We also invite them to our lab where we hold workshops on the proper use of machines, team organization, programming, and CAD training. We also help secure government funding for fledgling teams in Taiwan by sharing our own FRC experiences.

**Describe how your team works with other *FIRST* teams to serve as mentors to younger or less experienced *FIRST* teams (includes Jr.FLL, FLL, FTC, & FRC teams)**

As a leading team in Taiwan, we consistently provide assistance for new teams by giving direct feedback and inviting them over to brainstorm, use facilities and tools, and develop game strategies. In addition to this, we have hosted several scrimmages for teams aspiring to join FIRST, allowing them to gain further insight into the game and improve their bot accordingly. We also run training workshops to strengthen the fundamentals of new teams and develop sustainable bonds with them.

**Describe your Corporate/University Sponsors**

Due to school guidelines, we are unable to receive external sponsorship, even when large companies offer it. However, Taipei American School (TAS) and Friends of TAS offer us all the support we need. Frequent donations by alumni, parents, faculty members, and other donors through Friends of TAS have allowed us to develop our robotics program to include artificial intelligence software, high-tech fabrication machines, and the new Tech Cube facility.

**Describe the strength of your partnership with your sponsors with special emphasis on the 2018/2019 year and the preceding two to five years**

Our partnership with our sponsors is truly unique. Each and every sponsor, whether they be alumni, faculty, or parent, holds a personal stake in the success of our program. FRC has brought a stronger focus on STEM at TAS, evident from the investment in high-tech equipment as well as an expanded Robotics & Computer Science curriculum. This, in turn, has equipped our members and the larger school community to become the next generation of innovators and leaders.

**Describe how your team would explain what *FIRST* is to someone who has never heard of it**

Beyond the traditional bounds of a classroom, the unique learning environment of FIRST fosters collaborative spirit within each member. The distribution of responsibilities in our six divisions - Mechanical, Electrical, Design, Programming, Statistics, and Logistics - opens up opportunities for student-led growth in creative innovation and leadership. Through cooperation and teamwork, the FIRST community fosters unbreakable bonds and offers an unparalleled venue for pursuing STEM education.

**Briefly describe other matters of interest to the *FIRST* judges, if any****Team Captain/Student Representative that has double-checked this submission.**

Emily Hsu

## Essay

It is Chinese New Year break, the only time the city of Taipei rests. The streets are eerily empty, the quiet air undisturbed by traffic. Yet, at two o'clock in the morning, one corner of Taipei remains brightly lit: the Tech Cube. As the city sleeps, our robotics lab comes to life with the gush of the waterjet, the clicking of keyboards, and the bustle of weary students—their eyes lit with a flame kindled by tenacity and teamwork.

### Origins of Raid Zero

In 2012, a group of 12 students came together with our mentor, Matt Fagen, to form the first FRC team in Southeast Asia. Little did they know that this was the beginning of a STEM revolution in Taiwan, with Team 4253 spearheading the entire movement, training and setting the foundations of 24 new FRC teams in Taiwan.

Unaware of this future, they sowed the seeds of FIRST in the most lackluster of locations: the basement storage room. With limited resources and facilities, the team handcrafted a robot from a metal bed frame and went on to win the Rookie All-Star Award in Hawaii, a ticket to the World Championship. These modest origins set the foundations for our team. Since then, a hardworking nature and unmoving passion have remained the defining features of Team 4253.

We have grown from 12 students to over 140 within seven years with five blue banners (3 last year!) and four more trips to the Championship. Over the years, we have come to embody our team name: Raid Zero. "RAID 0" is a technique of using multiple disks for data storage that reduces redundancy and boosts performance. Likewise, our team has six divisions: mechanical, design, programming, electronics, logistics, and statistics. Thus, members can specialize in different fields and complete various tasks in tandem. Through a student-mentorship system, knowledge from past years is retained as veterans pass down their expertise to future generations, ensuring that the database of skills only increases.

### School Impact

As news of the exciting FRC experience swept through the school, Taipei American School (TAS) became energized toward the opportunities of robotics and engineering, envisioning a challenge-based education that develops skills applicable to solving real-world issues. The school curriculum and the school itself drastically expanded to envelop rapid changes. From a single teacher sprouted an entire Robotics & Computer Science (CS) department staffed with seven full-time faculty members.

Our school initiated robotics programs from K-12, including 18 Robotics & CS courses, ranging from beginner to advanced level such as Artificial Intelligence, Virtual Reality (VR), and Quantum Computing. By collaborating with the Girls in STEM club, we invited Middle School (MS) girls to the lab, and introduced the machinery and competition bots. As a result, female enrollment in STEM courses has increased from 10% to 50% in just two years. Over 42% of Upper School (US) students are taking Robotics & CS classes every semester. In 2013, our school became the first in the region to introduce a Robotics & CS graduation requirement. The school is also starting a US course to mentor Lower School (LS) students in FLL, using LEGO Mindstorms to introduce youth to the wonders of STEM.

In just seven years, we went from a dilapidated basement room to a brand new five-story robotics facility. Our passionate school community raised \$10M to create a facility for design, technology, and robotics: the Tech Cube. Unveiled in January 2019, this building provides 4,380 square meters of usable space for K-12 students. Facilities include an amphitheater with "tinker and maker" spaces on the LS floor; a VEX arena and robotics design lab on the MS floor; a high-performance computer lab, a fabrication shop with state-of-the-art equipment, and a full-sized FRC field on the US floors! These facilities foster an early passion for robotics and calibrate young minds towards solving the world's most pressing issues.

### Community Outreach

Given our unforgettable experience with FRC, we had the desire to spread this opportunity beyond our school. We started by reaching out to underrepresented communities in Taiwan. In 2012, our team collaborated with the Taipei School of Special Education and the Taipei School for the Visually Impaired to invent mechanisms, including a breath-controlled electric wheelchair and ultrasonic-sensor necklace for the visually impaired, allowing local students to see real-life applications of STEM.

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We went on to lead hands-on activities such as constructing parachutes to land eggs and creating Rube Goldberg machines at a remote elementary school in Taoyuan. This school earned an honorary award from Taiwan's Minister of Education because of our camp! Our team members also took charge of the Science division in the Huatung English Camp, and taught 180 impoverished aboriginal students STEM concepts through interactive activities such as Hour of Code. The wide grins on the students evoked a sense of nostalgia as we spread the very emotions that defined our own FRC experience.

Moving beyond schools, our members began to serve as consultants to a local coding and robotics company, harnessing VR technology suitable for 21st century education. Demos were brought to schools, and over 1400 young students across Southeast Asia were introduced to VR. This endeavor was featured on local news channels, sparking more interest in the endless possibilities of technology in our community.

### FIRST in Taiwan

Due to the rigid Taiwanese educational system, many local students dedicate their time to standardized test preparation and miss out on extracurriculars like FRC. To upend these deeply rooted educational trends, we cold-called over 60 high schools to generate interest in FIRST. In 2016, we successfully started two FRC teams: Team 6083 in Chiayi, and Team 6191 at Taipei First Girls' High School.

To get new teams off the ground, we invite them to our lab to brainstorm designs, provide materials for their first robot, translate manuals, and teach them how to find sponsors, a crucial aspect for long-term success. With our new FRC field, we have invited more than 15 local teams over for friendly scrimmages, allowing them to gain driving experience, test mechanisms, and receive direct feedback to improve competition performance.

We have continued to spread FRC across the nation by reaching out to Taiwan's Ministry of Education and government bureaus. As a result of our relentless advocacy, the Taiwan government has committed itself to FIRST Robotics. They have acquired a full-time staff for FIRST in Taiwan, who have been collaborating closely with us on projects to further expand robotics education, and have set aside a generous budget to support schools in their pursuit of FIRST Robotics! The Mayor of Taipei has also started sending teachers and principals to study our robotics program and the Ministry of Education frequently contacts our alumni for advice on FIRST, from constructing fields to initiating new programs in remote schools.

In October 2017, our team collaborated with the Taichung City Government on creating the first FRC workshop in Taiwan. Along with Teams 6083 and 6191, we hosted a panel discussion to share our FRC experiences to education ministers, robotics association executives, school principals, and 300 students from over 20 schools. These students then divided into teams to build and compete with standard FRC bases under the guidance of our veterans. Through this eye-opening workshop, students discovered a world where their imaginations can run wild, inspiring school administrators to initiate FIRST programs at their respective schools.

This past summer, our veterans traveled to Taichung to run a two-day intensive FRC training camp for 22 new government-sponsored teams. We designed a general-purpose FRC bot made with accessible parts from Taiwan, organized the tools and materials, and guided each team through the entire build, assemble, wire, program, and drive process. From missing pieces to broken parts, we worked with the students to come up with innovative solutions to the problems we encountered. Nevertheless, in two days, we successfully built 22 robots and welcomed over 200 students into the world of FIRST!

Recently, we partnered with the Compass Alliance to provide free published resources for FIRST teams around the world. Alongside Team 3332, our members translate the game manual among other guides for the FRC competition into Chinese, tearing down the daunting language barrier that impedes many Asian teams from joining FRC.

In a mere seven years, we have gone from being the only FRC team in Southeast Asia to one of 24 teams, all of which we played a significant role in founding. Due to this massive expansion of FIRST in Taiwan, FRC has agreed to hold the first ever Taiwan Regional in 2020! FIRST President Don Bossi himself even visited Taiwan this past fall to witness the extensive contributions we made to FIRST Robotics and attend the commitment ceremony for the new regional. The regional will be held in a \$10M FRC facility funded by the government for all students in Taiwan. This unprecedented facility gives Taiwan's fledgling FIRST community a strong backbone and serves as a beacon for all Taiwanese schools to follow, a symbol of a changing STEM and educational culture in Southeast Asia.

Team 4253 emerged in a region where educational institutions and academic pressure stifle creativity and enforce learning by rote memorization. We have surmounted an array of challenges in the face of age-old cultural attitudes towards STEM education, but our mission is far from over. Holding training camps, working with government officials, translating game manuals—this is merely the springboard of spreading our passion for FIRST. Chiseling at the system, we will continue to etch out a future where generations of students can engage in the unparalleled experiences of FIRST Robotics.