1 Team PML 30 –Y

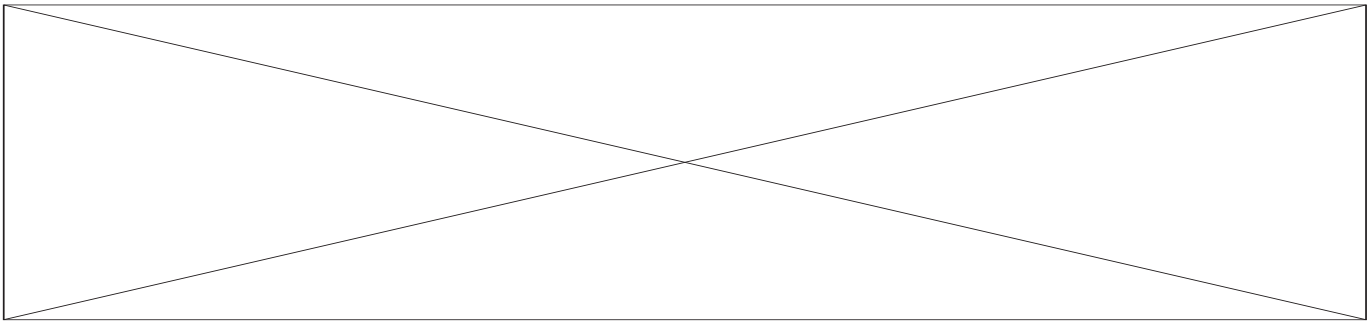
Team PML 30 – Y was assembled in October 2015 in Saint-Petersburg, Russia from 2 novices and 3 participants with experience, who took part in PML30 – φ and PML 30 – ψ teams in season 2014 - 2015. New team is based on the FTC teams that existed in our laboratory since October, 2012.

Tasks and roles of robot designing were distributed among the participants, and safety rules were established. At the first place we put spreading principles of gracious professionalism to others. All decisions were made collectively inside team with discussion to find the most optimal solutions, every idea was discussed in details to avoid missing interesting idea or making wrong decision.

During the year we took part in many events and everywhere we have tried to attract attention to our team, encourage people to take part in FTC and helped competitions organizers in the way of explaining rules and making regional qualifies as official as regional finals. Also we pursued and distributed the principles of gracious professionalism. Talking to the press, we hoped to attract more attention to our team and to the competition in general, as well as attracting sponsors. The latter was important because of the need for funds - purchasing materials and equipment costs a lot.

The team took part in the three qualifying competitions and in the regional finals. We have met number of team there and share our experience with them. Aside from meeting new teams we also kept in touch through Facebook with teams we met during previous years: Stuy Fission 310 from USA who we met in Sochi last year, a team from Romania, Auto Vortex who we met on regional finals the same season. Also, there is an active group chat with a large number of Russian teams. You can find the team page in Facebook at the address https://www.facebook.com/pages/FTC-team-PML30-PHI. To increase the efficiency of our team work we used the version control system GitHub, which allows the entire team to work simultaneously on a single projects without losing files and providing easy way to resolve problems. Also for writing technical books we had used professional typesetting system LaTeX.

For our team spreading information about FTC is very important and we try to motivate to take part in it as much people, as possible. We consider FTC very useful and interesting competitions, so we are very happy to participate in it.



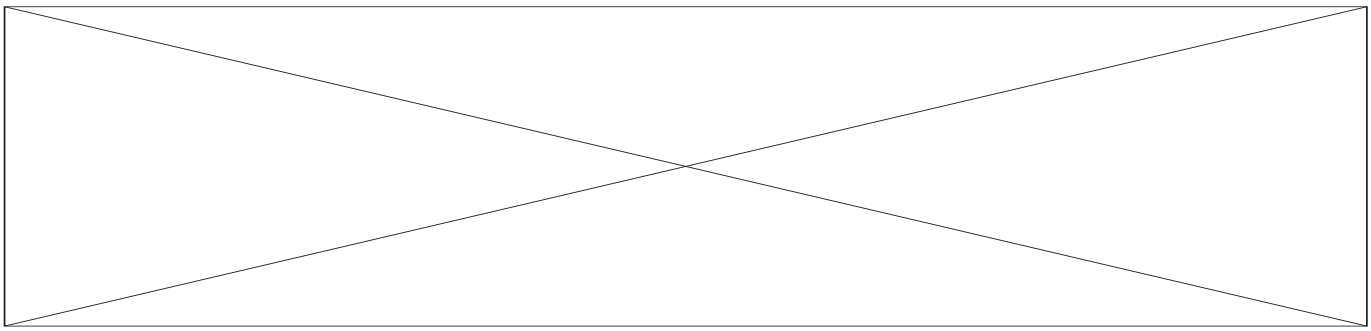
1.0.1 Instructors

Dmitry Luzin
Head of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Main coach of FTC team.
Information: 25 years old, in robotics 5 years, in FTC 3 years.

Ekaterina Luzina
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 25 years old, in robotics 5 years, in FTC 3 years.

Anton Fedotov
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 22 years old, in robotics 4 years, in FTC 3 years.

Georgii Krylov
Professor of Robotics Department in Phys-Math Lyceum 30, Saint-Peterburg, Russia. Tutor of FTC team.
Information: 18 years old, in robotics 4 years, in FTC 4 years.



1.0.2 Team members

Nikita Safronov
Role in team: captain, reserve operator-2, responsible for writing the technical book, responsible for elevator and winch.
Information: 17 years old, in robotics 4 years, in FTC 2 years.
Why I chose FTC: "I have chosen FIRST because I enjoy working with mechanisms and finding unusual technical decisions for solving problems. Also working on this project helps me to get new skills in a sphere of engineering. In this case I know, that I don't spend my time in vain."

Alexandr Iliasov
Role in team: operator-2, decorating robot, Power Design, responsible for the bucket.
Information: 16 years old, in robotics 3 years, in FTC 2 year.
Why I chose FTC: "I choose to partipucate in the FTC, because it requiers many skills in a lot of interesting themes: physics, engineering, programming, geometry. Also, you need to work in team, argument your choise and listen others. You need find problems and solve it. All that skills you can obtain in FTC."

Anton Ponikarovsky
Role in team: communication with other teams and community, responsible for system for scoring alpinists.
Information: 17 years old, in robotics 3 years, in FTC 2 year.
Why I chose FTC: "I decided to join FTC because I believe that this competition is one of the most challenging of those, which are familiar to me. It requires responsibility, capability of working in team, communication with other teams, working on hardware, software and even tecnical documentation. All the experience you accumulate through doing FTC, you can apply in your future profession, if it is technical oriented."

Andrew Nemow

Role in team: reserve drive-operator, responsible for the writing the program, responsible for debris collecting systems.

Information: 16 years old, in robotics 2 years, in FTC 1 years.

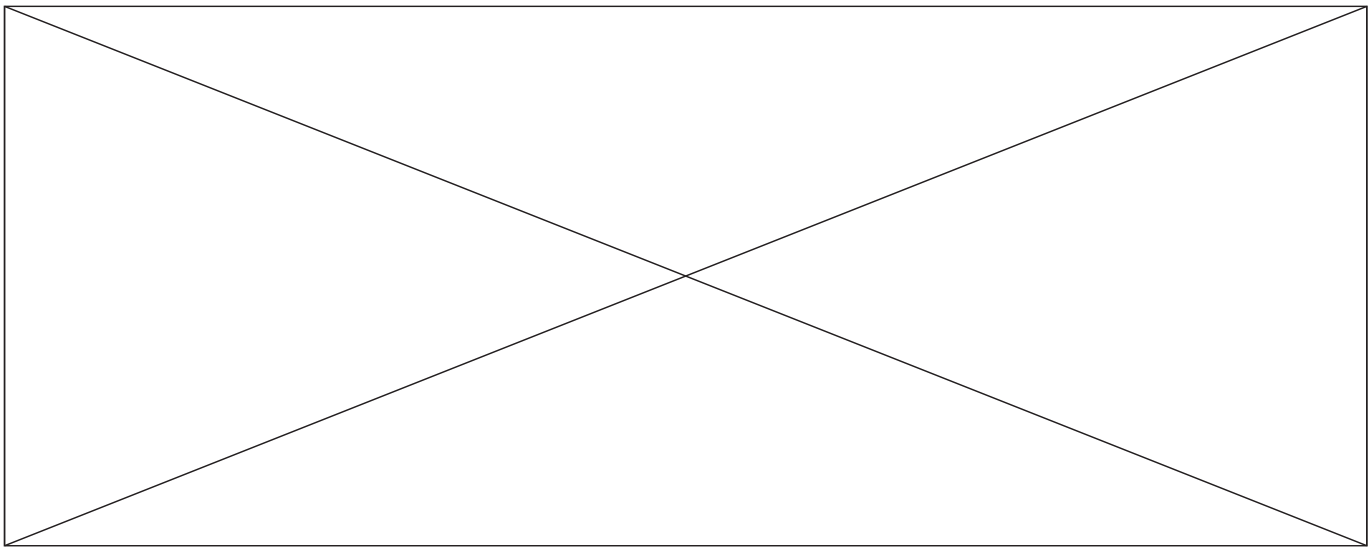
Why I chose FTC: "When I first I attended the event FTC saw hefty metal robots, with enthusiasm and without hesitation decided that I would like to do this."

Gordei Kravzov

Role in team: drive-operator, development strategy in the game, responsible for chassis.

Information: 16 years old, in robotics 2 years, in FTC 1 year.

Why I chose FTC:"I enjoy making huge and complicated mechanisms work, that's why I chose FIRST FTC. In my opinion it's a great way to improve your skills and broaden the mind doing something that you love by the whole heart."



2 Thanks and prospects

We enjoyed working on a custom and non-standard project, which, besides its technical aspect, included working with new people who shared our values of friendship and mutual understanding.

Our team is planning to continue doing robotics, setting new goals for ourselves in order to improve. This is our first year taking part in FTC and we will participate next year as well. If we don't realize ourselves this year, we'll look at all our mistakes, correct them, and preform a lot better next year.

In any case, we are ready to learn new things, improve ourselves and expand our skills.

None of us know for sure what we want to do in the future, but we are certain that our experience will be very valuable to us.

Our thanks go to the company FIRST for organizing this competition, which we are very happy to be participating in. We appreciate this wonderful opportunity to test ourselves and learn something new and wish them success and growth in their future endeavours.

Also we thank our sponsors: company PTC and it's Russian representative "Irisoft"and charitable foundation "Finist"for their support. Also we thank Physics-Mathematics Lyceum 30 and it's director Alexey Tretyakov for providing comfortable conditions for preparation to competition.

Team PML 30 φ

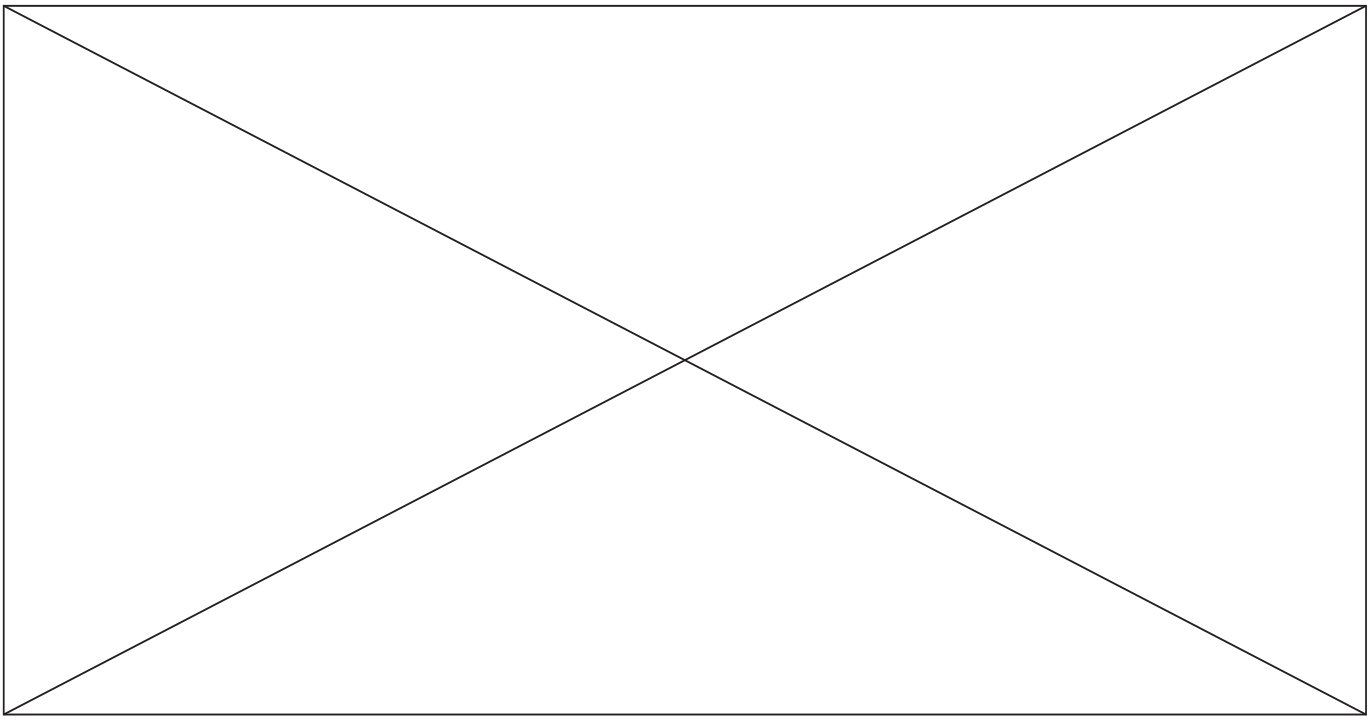
3 How to read this book

The book consists of 4 chapters.

1. The first is an introduction. Here is represented information about our team, our instructors and sponsors.
   At the end of introduction you can find short dictionary which contains specific terminology used in our book. It is needed to clarify the meanings of some terms that can be interpreted by the reader ambiguous.
2. The next chapter is a "Business plan". There represented information about our sponsors' support and our budget.

3. The Engineering chapter consists of two parts.
   - The consequence of meetings, which show our progress in elaborating. This parti includes sections 1 to 4.
   - Documentations for each module and for tele-op and autonomus programs. These materials are available in sections 5 and 6.

   This approach allows to show the engineering process from two sides: development of the robot in general and development of each module in particular.
   The 7 section of Engineering chapter is "Key summary". It contains conclusive abilities of our robot in the game.
4. Appendix includes a number of additional materials.
   - The list of raw materials applied in robot.
   - The example of leaflet with our robot's characteristics that we intend to distribute among other teams to make them know about our abilities.
   - The information list for judges.



4 Business plan

4.1 Introduction

We take a responsible approach to finding sponsors. We also strive to spend money effectively purchasing details and equipment we need, finding ways to get maximum benefit. For instance, some of the TETRIX sets that we have were received as prizes in competitions.

4.2 Our sponsors and their support

4.2.1 PTC and Irisoft

PTC and Irisoft representative in Russia is the one company that has helped us to begin to engage the FTC. They provided us with the first TETRIX set within the program "Score Technic"which involved our Lyceum. They provide us with CAD "Creo Parametric"that we use in engineering. They also help us with the delivery of details from the USA.

4.2.2 Robofinist

Robofinist Charitable Foundation organized by Temur Amindzhanov and organisation Starline. As a local organization, they offered their support to us. They help us financially providing with 2000 $every month, purchasing materials and equipment.

4.2.3 Physics-Mathematics Lyceum 30

Physics-Mathematics Lyceum 30 is an establishment that provides us with comfortable facilities for working.

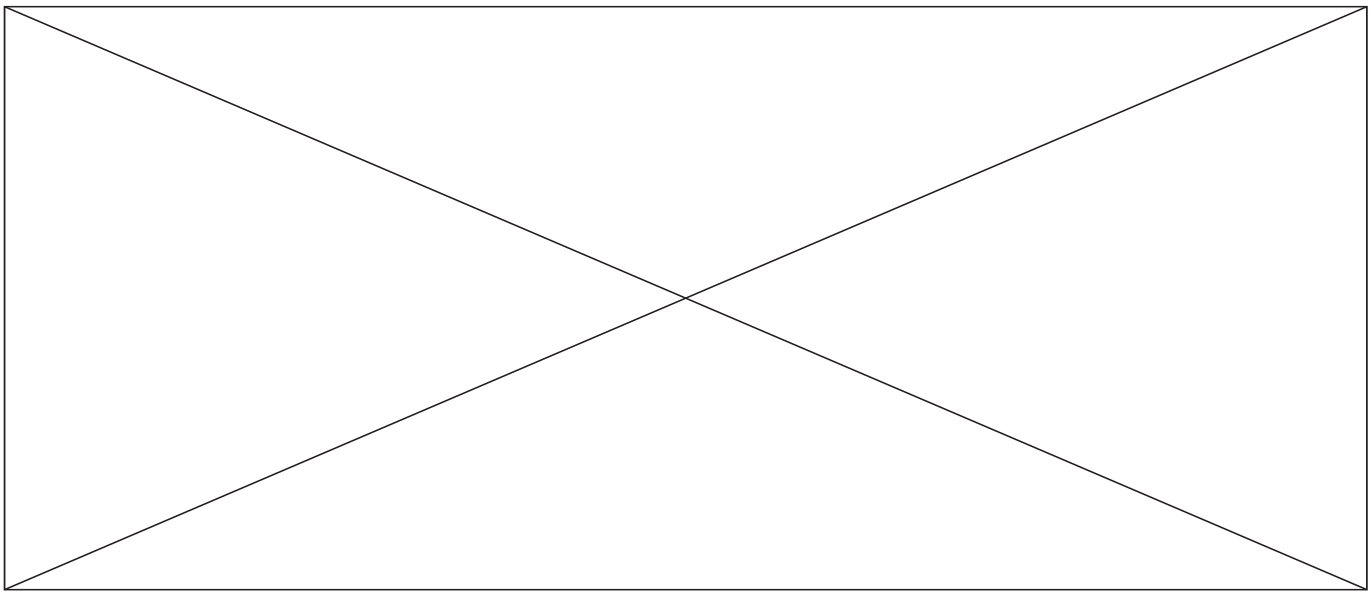
4.3 Our resource and financial situation

Таблица 1: Resources that we had at the beginnning of season 2015-2016.

Name	Amount
Basic TETRIX Max kits	4 sets
Resource TETRIX Max kits.	4 sets
Andy Mark NeveRest DC motors.	12 motors
Extra TETRIX DC motors (beyond kits).	10 motors
TETRIX Max chains and gears for them.	4 sets and extra gears
TETRIX Max 4 inch omni-wheels.	8 wheels
Servo MG 995.	25 servos
Extra TETRIX Max Battery packs (beyond kits).	4 parts
Tetrix Max caterlillars.	2 sets
Box for transporting robot.	1 piece
Matrix resource kit.	1 set
Joysticks Logitech F310.	2 joysticks
Lego Light, Touch and RGB Sensors.	Over 10 each
Hi-Technic Compass, Gyro and Colour sensors.	1 each

Таблица 2: Our expenses in season 2015-2016.

Name	Price (roubles)
New components that were purchased during this season	
FTC RESQ playing field.	106 000
New Android system (3 Modern Robotics Electronic Modules&Sensors Kit + 2 phones Motorola Moto G).	178 000
Another box for transporting robot and elements.	4 500
2 Servo S4315R.	4 000
1 Servo F5519M.	3 000
Wires 1.5mm.	720
Consumable materials (tape, cable screeds).	500
TETRIX components.	70 000
Rubber hose.	500
USB hub.	700
Aluminium construction profiles.	4 200
Blocks.	800
Rope.	180
Furniture slats 45 cm.	300
Workbench and vise.	23 500
Joysticks Logitech F310.	6 000
Purchasing total	*402 900*
Competitions that we took part in during this season	
Trip to "Robofest-South"in Krasnodar.	38 500
Trip to "Robofest-Ryazan".	16 100
Trip to FTC "Scrimage"in Nizhny Novgorod.	10 500
Trip to "FTC RUSSIA Open 2016"in Sochi.	100 000
Trips total	*165 100*
Game total	***568 000***



4.4 Key summary

Description: Here are marked the tactical and technical characteristics of the final version of the robot.

Таблица 3: Tasks that the robot can perform according to its construction.

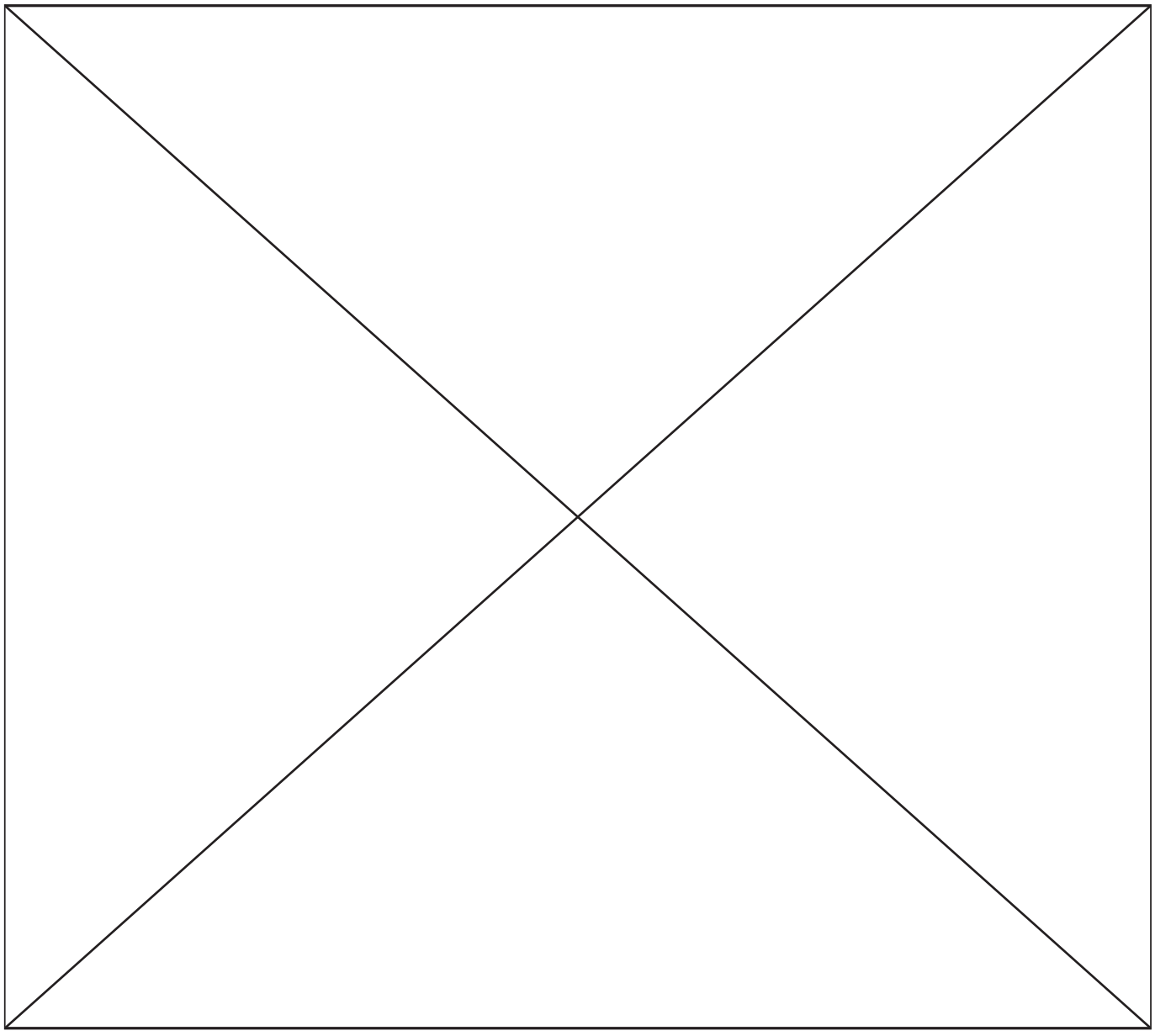
Tasks	Ability
Score climbers into shelter in autonomous period.	Yes.
Push the button on rescue beacon in autonomous period.	No.
Stay in beacon repair zone at the conclusion of autonomous period.	Yes.
Climb on mountain in autonomous period.	No.
Block the opponent's autonomous movement.	No. We consider that blocking is unfair.
Score zip-line climbers in tele-op period.	Yes, first and second ones.
Score debris in floor goal.	Yes.
Score debris in every mountain goal.	Yes.
Stay fully in low zone at the conclusion of tele-op period.	Yes.
Stay in second or top zone or pull-up at the conclusion of tele-op period.	No.
Turn the "All Clear"signal.	Yes.

Таблица 4: Consequense of performing tasks in the match

Task	The time needed to perform (sec)	Points
Autonomous period		
Score climbers into shelter.	20	40
Stay in beacon repair zone.	10	5
Autonomous total	30	*45*
Tele-op period		
Score low and second zip-line climbers	15	40
Score 10 cubes ($5cubes \cdot 2times$) into the top goal.	90	150
We can score 10 cubes ($5cubes \cdot 2times$) into the second goal instead of top if it would be pre-discussed with ally.	90	100
Turn the "All Clear signal"	15	20
Stay in low zone at the conclusion of tele-op period.	—	10
Tele-op total	120	*220 (170)*
Game total	150	***265 (215)***

Таблица 5: Actions in extraordinary situations

Situation	Action
The autonomus program didn't run.	Score climbers into shelter in tele-op period.
Scoring debris into mountain goals is impossible due to break.	Score debris into floor goal.
Our ally lost ability of scoring debris into mountain goals in case he was to score debris into the top goal.	Firstly, we ask ally if we can score debris into the top goal instead of them. If he confirms that we can perform his game objective, we start scoring debris into top goal as it gives more points. If he rejects the suggestion (if, probably, alliance robot cann't leave the mountain), we continue performing our game objective



4.5 Leaflet for teams

Team FTC-15

PML30-Y

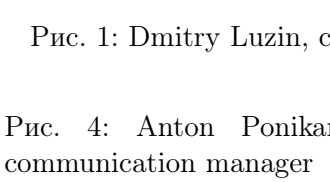


Рис. 1: Dmitry Luzin, coach

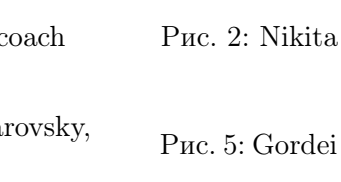


Рис. 2: Nikita Safronov, captain

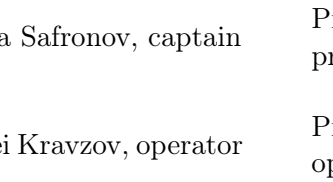


Рис. 3: Andrea Nemov, programmer

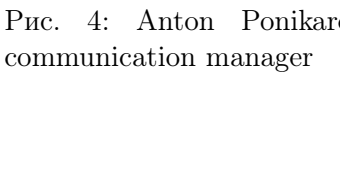


Рис. 4: Anton Ponikarovsky, communication manager

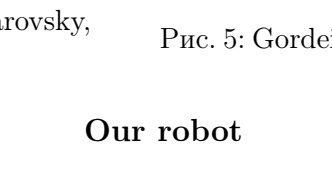


Рис. 5: Gordei Kravzov, operator

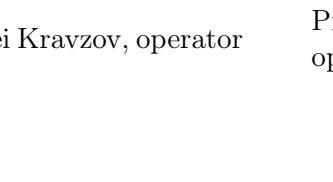


Рис. 6: Alexandr Iliasov, operator

Our robot

Our score

Task	The time needed to perform (sec)	Points
Autonomous period		
Score climbers into shelter.	20	40
Stay in beacon repair zone.	10	5
Autonomous total	30	*45*
Tele-op period		
Score low and second zip-line climbers	15	40
Score 10 cubes ($5cubes \cdot 2times$) into the top goal.	90	150
We can score 10 cubes ($5cubes \cdot 2times$) into the second goal instead of top if it would be pre-discussed with ally.	90	100
Turn the "All Clear signal"	15	20
Stay in low zone at the conclusion of tele-op period.	—	10
Tele-op total	120	*220 (170)*
Game total	150	***265 (215)***

4.6 Information for judges

Team PML30-Y (FTC-15)

The basic principle we followed in engineering is modular. Our robot was divided into several modules and for every module there was appointed a responsible person from the team members. There are 4 main modules in our robot. They are:

1. Wheel base - a system that provides movement of the robot. Responsible - Gordei Kravtsov.
2. Gripper - a system for collecting debris. Responsible - Andrew Nemov.
3. Bucket - a system for keeping debris until it will be put into a goal. Responsible - Aleksandr Iliasov.

4. Elevator - a system for delivering the bucket to middle and top goals of the mountains. Responsible - Nikita Safronov.

In our technical documentation there is a special section named "Specifications for modules"which is dedicated to the development process of modules in particular. In this section you can find more information about modules mentioned above.
Software specifications are available in section named "Specifications for programs".
General development of the robot in progress is represented in chronological section. This section contains information about all the team meetings including discussions and days of competitions (it mentioned in the title of meeting).
Our abilities and our strategy in the game are provided in section "Key summary".
In the section "Appendix"you can find":

1. The list of raw materials used in robot.
2. The example of leaflet with our robot's characteristics that we intend to distribute among other teams to make them know about our abilities.
3. The information list for judges (which you are reading right now).

You can learn more about the structure of our technical book in the section "How to read this book".