

AUTONOMOUS ROBOTIC SYSTEMS TEAM INTELLIGENT GROUND VEHICLE COMPETITION

Sponsorship Package
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Sponsored by:



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Table of Contents

THE UNIVERSITY OF TORONTO ROBOTICS ASSOCIATION	4
<i>Table 1 - University of Toronto Robotics Association - A History of Excellence</i>	4
<i>Fig 1 - UTRA's Calendar and Events Map for 2011</i>	4
THE AUTONOMOUS ROBOTIC SYSTEMS TEAM - IGVC	5
<i>Table 2 - IGVC Challenges and Points Distribution</i>	5
SPONSORSHIP	6
SPONSORSHIP OPPORTUNITIES	6
SPONSORSHIP RETURNS	6
SPONSORSHIP BENEFITS	6
APPENDIX A: IGVC BUDGET OVERVIEW	7
<i>Table A.1 - Preliminary Design Budget</i>	7



UTRA's Gold Medal winning Robot "TSAInspected" (left) at the RoboGames 2010



Executive Summary

The University of Toronto Robotics Association is an organization aimed at realising the aggregate potential of all the disciplines within the Faculty of Applied Science and Engineering through the design, building and maintenance of robots. These robots are entered in recognised international annual robotics competitions, including the Intelligent Ground Vehicle Competition, BattleBots, Motorama, RoboGames, and other Robot Fight League-sanctioned competitions. The UTRA has a history of excellence, having won a Gold Medal (RoboGames 2010), two Bronze Medals (RoboGames 2009 and 2008) and one Second Place finish (Firefighting Robot Contest); for which it has earned recognition across Canada. Currently, nearly 200 students have committed themselves to the Association with a strong, positive response from the student engineering community as a whole.

The international Intelligent Ground Vehicle Competition (IGVC) is an annual robotics competition organized by the Association for Unmanned Vehicle Systems International (AUVSI) in association with the United States (US) Department of Defense (DoD), the US Army and USMC Joint Projects Office and several industrial partners. The Autonomous Robotic Systems (ARS) IGVC team will design and build a completely autonomous intelligent ground-borne robotic vehicle capable of self-navigating over multiple terrains and avoiding complex obstacles while carrying a payload, using only the systems on-board the vehicle.

The ARS team is currently looking for sponsorship in order to meet its budgetary requirements, adding up to roughly \$12,000 [Appendix A]. Sponsorship can be provided through donation of direct funds or equipment or through the provision of services and expertise. Through partnership with the UTRA, sponsors will gain direct access to a large pool of committed engineering students (for employment, workshops, seminars, training etc.) while making a direct contribution within the engineering community and towards its future. In addition, the UTRA will arrange demonstrations and events exclusively for sponsors and represent the sponsors' title on its robotic vehicles, uniforms, websites, documents and media coverage.



UTRA Bronze Medalists at RoboGames 2008 and 2009



The University of Toronto Robotics Association

“Our mission is to inspire science and technology leaders, by engaging them in the design and construction of advancing robotic technology, that inspire innovation, and foster the skills of science and engineering, as well as well-rounded life capabilities of creativity, communication, and teamwork.”

UTRA is an organisation committed to designing and building robots through the use of students’ skills drawn from all areas of science and engineering. Through participation in various international robotics competitions, the UTRA provides students with invaluable experience in science and technology, while increasing awareness of industry relevant issues and robotics in general. The UTRA increases the profile of the University of Toronto and its sponsors through entries and successes in various competitions such as the IGVC, BattleBots, Motorama, Sumo Robotics, RoboGames, and through mentorship in the US FIRST High-School Robotics Competitions.



Award	Year	UTRA Robot	Competition
Gold Medal	2010	120-lbs Combat Robot “TSA Inspected”	RoboGames – Combat
Bronze Medal	2009	120-lbs Combat Robot “TSA Inspected”	RoboGames – Combat
Bronze Medal	2008	120-lbs Combat Robot “Wedgeemout”	RoboGames – Combat
Second Position	2005	Firefighting Robot	Fire Fighting Robot Contest

Table 1 - University of Toronto Robotics Association - A History of Excellence

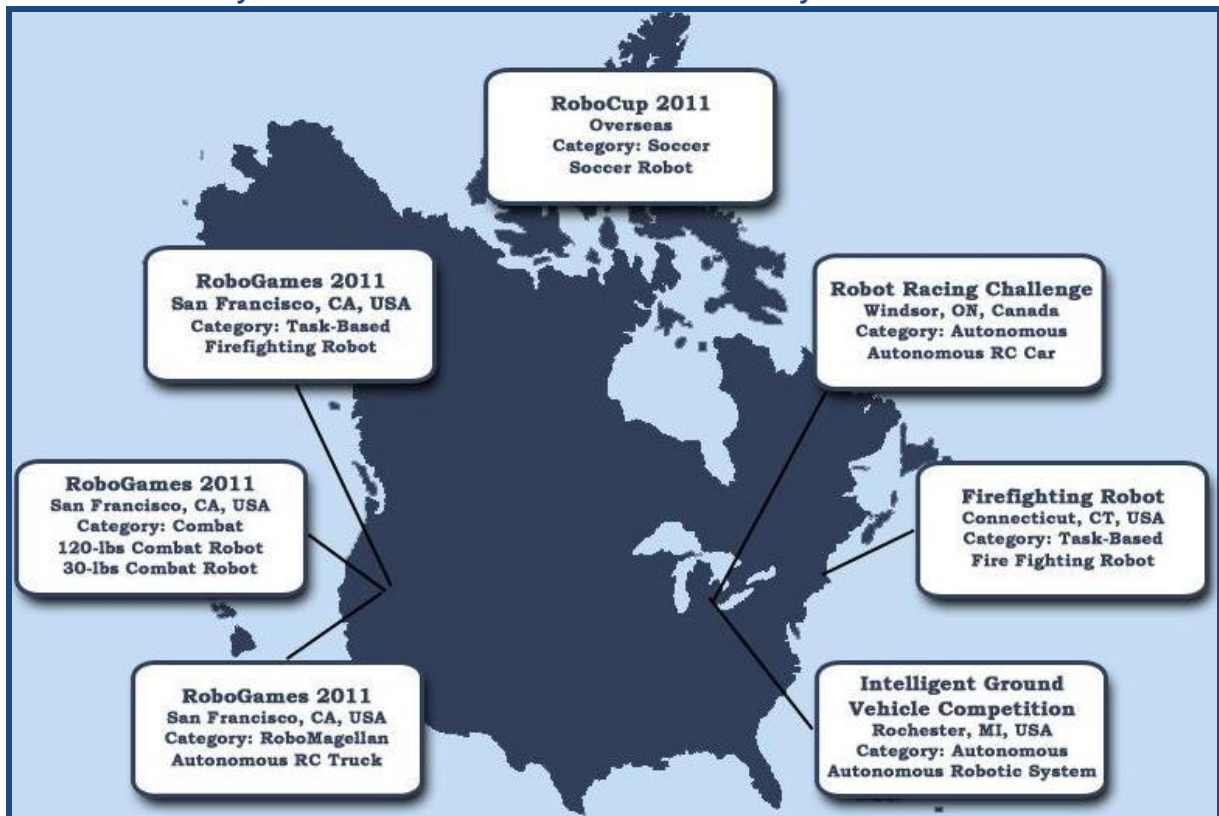


Fig 1 - UTRA’s Calendar and Events Map for 2011



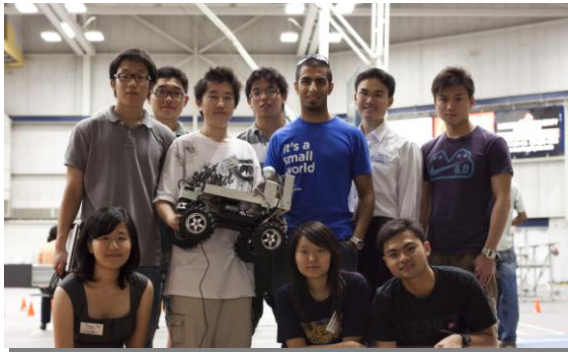
The Autonomous Robotic Systems Team - IGVC

“The IGVC offers a design experience that is at the very cutting edge of engineering education. It is multidisciplinary, theory-based, hands-on, team implemented, outcome assessed, and based on product realization.”

- IGVC.org/objective.htm

The Association for Unmanned Vehicle Systems International, in association with the United States Department of Defense, US Army and USMC Joint Projects Office and various other non-governmental organizations, organizes the international Intelligent Ground Vehicle Competition annually in Rochester, Michigan, USA.

The primary objective of this competition is to have university teams from around the world design, construct and compete fully autonomous intelligent ground-borne robotic vehicles. The



competition promotes the use of multi-disciplinary cutting-edge technologies utilizing and impacting current industrial research and development. In addition, a secondary objective of the competition is to encourage participating students to interact with and learn from industrial partners, while taking leadership responsibilities in technical areas within the team environment. Knowledge and experience gained from this competition are directly applicable to the engineering industry

at large, specifically in the fields of unmanned systems engineering related to military applications, intelligent transportation systems, manufacturing etc.

Autonomous Challenge	Max: 48pts - US\$5,000
Negotiate around an outdoor obstacle course while staying within the path boundaries.	
Navigation Challenge	Max: 36pts - US\$4,000
Navigate around a large area towards a set of fixed waypoints while avoiding any and all obstacles on the course.	
Design Competition	Max: 24pts - US\$3,000
A panel of judges from within the industry and the military will judge the robotic vehicle based on an inspection, a written report and a team presentation.	
J AUS Challenge	Max: 24pts - US\$3,000
Demonstrate the implementation of the US DoD developed Joint Architecture for Unmanned Systems (JAUS) standard for communication between sub-systems in a network containing unmanned systems.	



Table 2 - IGVC Challenges and Points Distribution

The Autonomous Robotic Systems team of the University of Toronto Robotics Association will be designing the University of Toronto’s first-ever entry into the IGVC competition in 2011. The team will apply knowledge gained from university courses as well as extra-curricular involvement and combine it with the knowledge gained from competition specific research to develop a fully autonomous robotic vehicle capable of competing in the four challenges of the IGVC.



Sponsorship

UTRA is supported by a strong network of educational institutions, industrial partners, and individuals within the University of Toronto. In order to meet the ARS Team's budgetary requirements, the UTRA will be expanding its pool of industrial and governmental partners. In addition to immeasurable benefits gained by students, sponsors and industrial partners are given the opportunity to collaborate with one of the leading engineering universities in the world, and have its title represented within the community and internationally by a team of students with a history of excellence in robotics.



Sponsorship Opportunities

Currently, the following types of industry sponsorships are being sought.¹

- Monetary donation: Companies or organizations may choose to make funds available to the ARS team to be used towards the IGVC robotic vehicle.
- Equipment or parts donation: Companies or organizations may make part or all of their product inventory available to the team either free of charge or at a reduced price.
- Services and expertise: Companies or organizations with expertise in certain fields relevant to the design project may be approached for expert technical advice and/or services towards the design project.

Sponsorship Returns

- Sponsor's Logo/Title on all team uniforms, brochures, and ads.²
- Sponsor's Logo/Title on the competing robot (competition, media coverage, etc).²
- Advertisement on the UTRA website with a link to the organization's website.²
- Sponsor's Title at all public events, including community seminars hosted by UTRA.
- Opportunity to conduct information seminar, training or event for UTRA members.
- Invitation to sponsors' appreciation event(s), to include:
 - A demonstration of the IGVC robotic vehicle (if possible).
 - Demonstrations of UTRA's award winning fighting robots.
 - An IGVC design presentation for all sponsors.
 - Interaction with members of the UTRA with complementary snacks.
- A visit from UTRA members to the organization's site for fighting robot demonstration.³

Sponsorship Benefits

- Strengthens the organization's reputation within the community.
- Builds a technologically literate work force.
- Creates a pipeline for quality interns and experienced future employees.
- Enriches branding as an institution committed to innovation and future investment.
- Offers representation at numerous professional academic institutions.

¹ Additional forms of sponsorship deals may be negotiated with the Project Lead, Rohaan Ahmed.

² Size and placement of logo is proportional to total value of sponsorship.

³ Depending upon the total value of sponsorship, Within the GTA only.



Appendix A: IGVC Budget Overview

The IGVC competition is designed to test advanced engineering principles, designs and practices with a focus on real world application. For these reasons, the competition involves the use of state-of-the-art hardware, software techniques and engineering theories. Due to the sheer complexity of the project, and in order to meet all competition requirements, the robot requires significant computing power as well as sophisticated sensing equipment and hardware on-board.

As a first-time entry, the ARS team is taking a pragmatic financial approach* by taking into account all resources available from various sources and looking to keep the costs as low as possible. The average total budget of previous first-time entries into the IGVC is approximately



\$17,000. However, through the formulation of a sound financial plan, including a comprehensive sponsorship strategy, and a realistic approach* to the budget, the team expects the robotic vehicle's overall cost for 2011 to be significantly lower than the average. In addition, the IGVC team hopes to build strong industry partnerships for future

budgetary considerations.

In this initial budget estimate, the team has included solutions that have been chosen in the preliminary design of the vehicle. The preliminary design is the first step in the detailed design phase of the project, and hence, the budget is not final. The purpose of this budget is to identify the economically viable and useful hardware, and to find alternatives for those that are unnecessarily affecting the budget in a negative manner. Table A.1 details the estimated prices of the preliminary design solutions.

Hardware	Estimated Cost
Laptop/Computer (x2)	\$1,500
Laser Rangefinder	\$4,500
Video Camera	\$1,000
Differential GPS	\$1,500
Digital Compass	\$1,500
Mechanical systems (gears, chassis, driving motor)	\$800
Power Supplies, Wiring etc.	\$400
Optical Encoders	\$200
Infrared Sensors (optional)	\$300
Miscellaneous	\$400
TOTAL	\$12,100

Table A.1 - Preliminary Design Budget

Keeping the above in mind, the initial budget estimate for the 2011 IGVC entry, based on a preliminary design analysis, is approximately **\$12,000⁴**.

* Pragmatic Approach

For the purposes of UTRA's first entry into the IGVC, most of the features in the very high-end of the available hardware have been deemed unnecessary or marginally more beneficial than the mid-ranged alternatives. Therefore, the team has decided to avoid high costs by going for mid-range systems and compensating for any deficiencies through innovative algorithms and higher code complexity. What makes this approach "pragmatic" is that the team realizes it may not be able to secure high-end equipment and material for this project, and will take this factor into account when designing the robotic vehicle.

⁴ Estimate is subject to change.



UTRA Gold Medalists at RoboGames 2010



UTRA Bronze Medalists at RoboGames 2009 and 2008

