

DARPA Robotics Challenge (DRC) 10 Years of Lessons Learned Put into Action

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DARPA Robotics Challenge (DRC) Report



- Overview
- History
- Why a Challenge
- Essential Components of Challenges
- Teams
- Key Components
 - Communications
 - Hardware
 - Collaboration
- Rules
- Location
- Venue
- Conclusions





Purpose of Report



- Provide an overview of the evolution of DARPA's Grand Challenges and their success in solving technology problems
- Clarify the DARPA Challenge brand that has been built over the past decade
- Provide lessons learned in operations, outreach, and event management to assist in future planning
- Present a high-level road map of the many factors involved in prize Challenges to groups that are considering running such Challenges in the future

Not to report on the technical impacts of the Challenges



DARPA Challenge History



What	When	Where	Winner	Prize
DARPA Grand Challenge I	March 2004	Barstow, CA	None	\$1 M
DARPA Grand Challenge II	November 2005	Primm, NV	Stanley (Stanford)	\$2 M
DARPA Urban Challenge	November 2007	Victorville, CA	Tartan (CMU)	\$2 M
DRC Trials	December 2013	Homestead, FL	Schaft – Japan	N/A
DRC Finals	June 2015	Pomona, CA	KAIST – Korea	\$2 M



The DRC consisted of two public events: the DRC Trials (December 2013), and the DRC Finals (June 2015).

The DRC Trials was not a prize competition, but rather a mid-point in the program

- Allowed the Government to identify which teams should receive support funding leading towards Finals
- Unfunded teams could participate to prepare for the DRC Finals

The DRC Finals was a competition

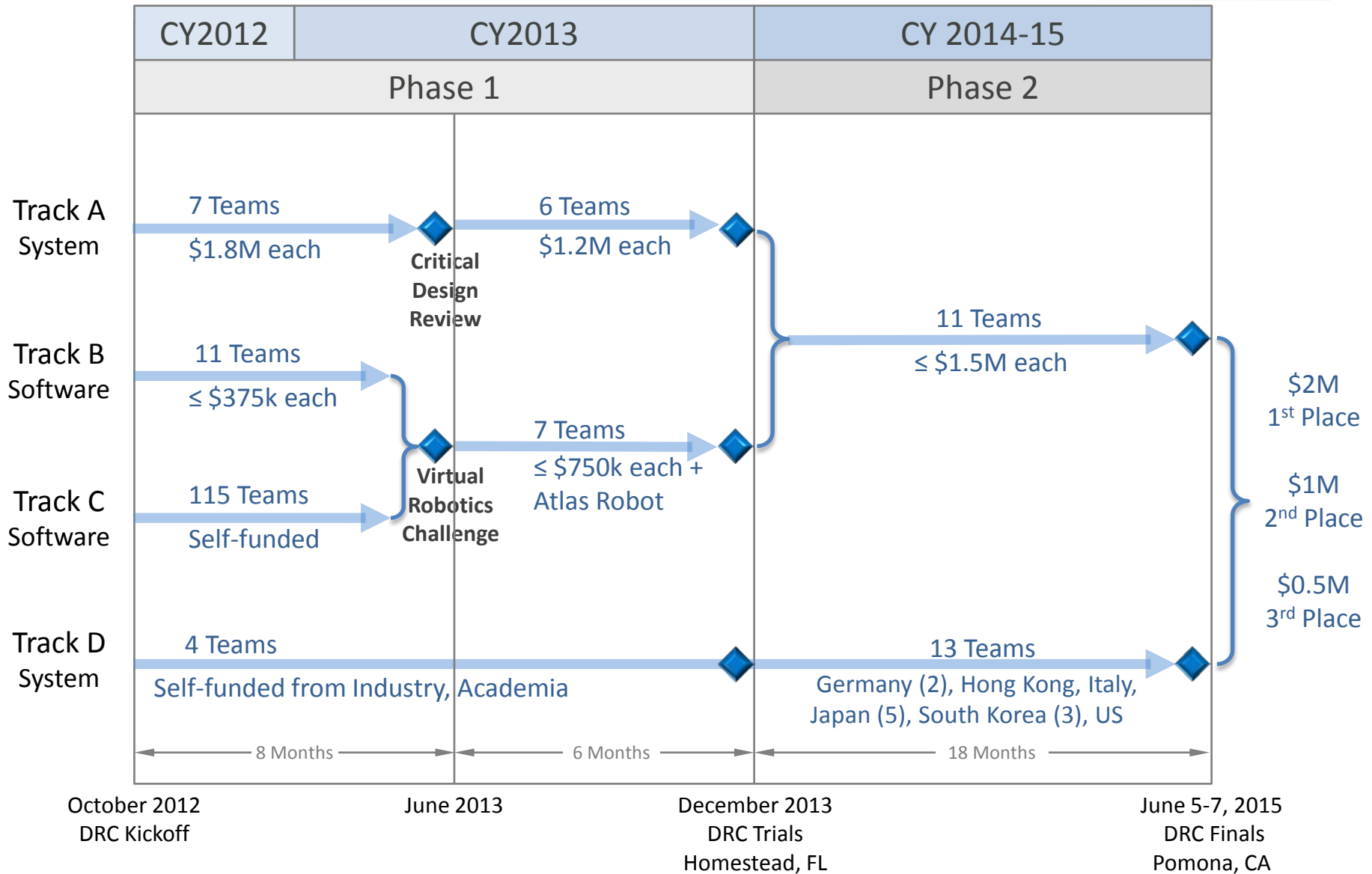
- 23 teams attempted to complete eight challenging tasks within a sixty-minute time limit
- The event place at Fairplex in Pomona, California, on June 5 and June 6, 2015
- Three prizes were awarded: \$2M for first place, \$1M for second place, and \$0.5M for third place

- Is this technical area lacking focus or need a shakeup?
- Is it acceptable if the work doesn't reach the end goal?
- Will the technical community and media be interested in participating and covering the event?
- If you build it, will they come?





DRC Program Structure and Funding



Note: Funding levels are approximate and vary by team.

THE DARPA ROBOTICS CHALLENGE FINALS

AN INTERNATIONAL COMPETITION

United States

Team Tartan Rescue	Team MIT	Team Trooper
Team DRC-Hubo	Team RoboSimian	Team VALOR
Team Grit	Team THOR	Team ViGIR
Team IHMC Robotics	Team TRACLabs	Team WPI-CMU

Japan

Team Aero
Team AIST-NEDO
Team HRP2-Tokyo
Team NEDO-Hydra
Team NEDO-JSK

South Korea

Team KAIST
Team ROBOTIS
Team SNU

European Union

GERMANY
Team Hector
Team NimbRo Rescue

ITALY
Team WALK-MAN

Hong Kong

Team HKU



Teams

- In order to attract both commercial and university based teams, various funding opportunities are needed
- Co-located teams usually perform better than geographically displaced teams

Communications

- Clear communications between teams and the organizers is critical
- Use of technology can be helpful, but most important to have all details in one place

Hardware

- Access to stable hardware is critical to teams' ability to develop
- Account for time in schedule for development and upgrades

Collaboration

- Collaboration is key to building rapport among the teams; driving competition and improvement; and cooperation to drive better capabilities post event



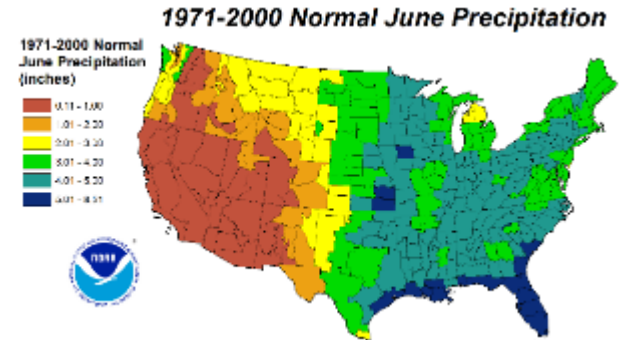


Setting the rules for the Challenge is one of the most difficult things in the process

- Rules can increase or decrease (intentionally and/or unintentionally) the level of technological achievements of the teams
- They need to be carefully thought out and set at the right level since they impact almost every aspect of the process
- Temptation is to make the event more successful by adjusting the difficulty so more teams can finish, but doing so can influence technical outcomes
- Small rules changes can have unintended consequences on the overall impact of the event

Factors to Consider during Site Selection

- Messaging: Why the location was selected over others
- Spectator needs: Balance between scientific demonstration and that of general spectators
- Ease of travel: Identify location that is easy to access for a broad cross-section of attendees
- Nearby lodging at a reasonable rate: Location is critical in attracting national and local interest, media
- Ability to view and participate in event: Balance required between scientific demonstration and that of general spectators



Planning Recommendations

- Partner with your facility or venue.
- Share the goals and objectives of your event
- Get to know venue's staff and responsibilities
- Leverage the facility's experience for outreach and planning.
 - Example – Use of communications systems already built into the Fairplex infrastructure was a critical component of the Finals' overall success. Was only discovered by working with staff





DRC video





- Some Initial Observations on DRC and All Challenges
 - Most teams that had stable hardware sooner, did better
 - Teams that were co-located did better than geographically split teams
 - Lock in the rules early, even if imperfect, several months out from the competition
 - Consider trade-offs between using a Challenge vs. a traditional program that affect near-term progress toward technical advances
 - Opportunities to test the technology/systems (Testbeds) are a great asset to organizer operations and performers
 - Key planning times: 12 months for organizers, 6 months for performers
 - Collaboration was a part of the success for many of the teams

The more challenges an organization does, they get better at them; from defining the problem, setting the challenge, balancing technology advances with spectator needs, staffing and setting general expectations.

Thanks to the team that made it happen

