



URBAN CHALLENGE

National Qualification Event

Southern California Logistics Airport
Victorville, CA



Welcome to the DARPA Urban Challenge!

The NQE represents the culmination of two years of intense effort by the 35 Urban Challenge semi-finalist teams who will compete for one of 20 spots in the Urban Challenge Event on Saturday, November 3rd. I am extremely proud of the teams and believe they will impress all of us at the rate of progress the robotics community has made since the first Grand Challenge in March 2004. The Urban Challenge prize competition has united engineers, scientists, backyard inventors, and students to develop autonomous ground vehicles that can save the lives of our men and women in uniform. Their enthusiasm and can-do attitude are contagious, and I know you will enjoy seeing them in action as they prepare their vehicles to compete in the different stages of the NQE. I want to thank all who have made this event possible and especially the supporters and sponsors who have helped the teams reach this important stage. Let the competition begin.

-Dr. Tony Tether, DARPA Director

The Urban Challenge

The Urban Challenge is designed to accelerate the development of autonomous ground vehicle technology for operations in traffic. DARPA is offering three prizes—\$2 million, \$1 million, and \$500,000 — to the top three vehicles that complete a complex 60-mile urban course with live traffic in less than 6 hours. Speed is not the only factor, vehicles must meet the same standards required to pass the California DMV road test.

From the time the robotic vehicle leaves the start chute and begins the course it is entirely under the control of its onboard mission computer – human observers may intervene only for purposes of safety. In the Nov 3rd Urban Challenge Event, the 20 finalists will operate on the course roads along with approximately 50 human-driven traffic vehicles. They will interact with each other just as vehicles in urban areas across America are on the road together, each traveling to a different destination. To be competitive for the prizes, the robotic vehicles must demonstrate they can complete the 60 mile course in less than six hours while driving safely and obeying all California traffic laws. The vehicles will face driving challenges including traffic circles, merges, four-way intersections, blocked roads, parking in a crowded lot, passing parked cars on narrow streets, and keeping up with the traffic flow on two and four lane roads.

Robotic vehicles able to perform safely in a dynamic urban environment represent a significant leap in technology advancement. Nothing like the Urban Challenge has ever been attempted. You have a front row seat to a very exciting event.

DARPA

The Defense Advanced Research Projects Agency (DARPA) is the central research and development organization for the Department of Defense. The Agency manages and directs basic and applied research and development projects and pursues research and technology where both the risk and payoff are very high and where success may provide dramatic advances for traditional military roles and missions.

Schedule

National Qualification Event

Friday, October 26

7:00am-7:30am	Opening Ceremony
7:30am-12:00pm	E-Stop and Vehicle Inspections
12:20pm-5:00pm	Vehicle Testing

Saturday, October 27 – Wednesday, October 31

7:30am-5:10pm Vehicle Testing

Urban Challenge Final Event

Thursday, November 1

TBA Announcement of Finalists

Friday, November 2

5:00pm-8:00pm Urban Challenge Barbecue*

Saturday, November 3

4:30am-8:00am	Event Day Breakfast*
6:30am-7:00am	Opening Ceremony
7:00am	Vehicles launched

Sunday, November 4

10:00am	Awards Ceremony
	Press Briefing to follow

**Tickets are available on a limited basis and can be purchased at the Information Tent.*

Urban Challenge Teams

#1
Mojávaton
White Knight
Grand
Junction, CO



Mojávaton is a team of professionals with over 150 years of combined experience in custom machine design, electronic controls, and vision system solutions.

Sponsors: Automation Direct, BOA Builders, Cognex, Control, CoorsTek, Entivity, Exceltech, General Technics, Genesis, Grid Connect, Interstate Batteries, Mesa State College, NavCom, Northrop Grumman, OmniSTAR, and Remote Control Technology.

#2
Team Caltech
Alice
Pasadena, CA



The team from the California Institute of Technology consists of undergraduates and graduate students, working with faculty, post doctorates, and industry partners.

Sponsors: AMCI, Applanix, BAE Systems, Big George Adventures, California Institute of Technology, JPL, Mohr Davidow Ventures, Northrop Grumman, and Wright Tools Technology.

#3
Stanford Racing Team
Junior
Stanford, CA



The team is drawn from faculty and students at Stanford's School of Engineering and sponsoring corporate partners.

Sponsors: Android, Applanix, Coverity Inc, Goggle, Honeywell, Intel, Mohr Davidow Ventures, NXP, Red Bull, Tyzx, Inc, and Volkswagen of America Electronic Research Lab.

#6 Team Jefferson
Tommy Jr.
Crozet, VA



Perrone Robotics and University of Virginia form Team Jefferson. Luminary professionals in the robotics and engineering industry provide guidance and support.

Sponsors: Assured Technologies, Inc., Bodine Electric Company, CSI Wireless, Eaton Corporation, FairIsaac, M.I.T.S. Corporation, OmniSTAR, Perrone Robotics, Inc., Sandtec Sand Rails, SICK Sensor Intelligence, and VIA Technologies.

#8
Gator Nation
Urban
NaviGATOR
Gainesville, FL



Gator Nation combines academic knowledge from the University of Florida with industry experience from Smiths Aerospace and Eigenpoint Company.

Sponsors: Air Force Research Labs, Animatics, CIMAR, Digi Key, Eaton VORAD, Gatorland Toyota, NavCom Technologies, NHRA, SICK Sensor Intelligence, Smiths Aerospace, Triad EDM, University of Florida, and Woodhead.

#10
OSU-ACT
ACT
Columbus,
OH



Students, faculty, and staff from Ohio State University form the OSU Autonomous City Transport (ACT) team with the support of other universities and organizations.

Sponsors: Advanced Motion Controls, Eskieshir Osmangazi University, Honda, Istanbul Technical University, MobilEye, National Instruments, Ohio State University, Sabanci University, Transportation Research Center, and University of Pisa.

#13
Team UCF
Knight Rider
Orlando, FL



Students and faculty from the School of Engineering and Computer Science at the University of Central Florida have joined with industry partners to form a team with the key technical expertise and management experience to meet the Urban Challenge.

Sponsors: Coleman Technologies.

#14
Insight Racing
Lone Wolf
Cary, NC



Insight Racing brings together a mixture of North Carolina State University alumni and local engineers with over 150 years experience in technology research and development.

Sponsors: Advanced Vehicle Research Center, Ascot Technologies, Control, Insight Technologies, Lotus, NC State University, NCCAR, Northrop Grumman, SAS, SICK, Smith Anderson, and TEKELEC.

#15
Intelligent Vehicle Systems
XAV-250
Troy, MI



The team is comprised of employees from Delphi, Ford, and Honeywell. Members from the 2005 IVS team have returned to contribute their experience and skills.

Sponsors: Delphi, Ford, and Honeywell.

Urban Challenge Teams

#18
The Golem Group
 Golem 3
 Santa Monica, CA



Building on a tight knit core of engineers and scientists, The Golem Group of students, scientists, and engineers has joined with an industry professionals to attempt the Urban Challenge.

Sponsors: BEI Technologies, GrammaTech, Intel Corporation, MobilEye, NovAtel, OmniSTAR, SICK, and UCLA.

#19
Tartan Racing
 Boss
 Pittsburgh, PA



Carnegie Mellon University's Robotics Institute has come together with General Motors to form Tartan Racing. Team members are employees of the Robotics Institute, and other departments within Carnegie Mellon University and General Motors.

Sponsors: Carnegie Mellon University, Caterpillar, Continental, General Motors, Google, IBED, Intel, McCabe Software, MobilEye, NetApp, Tele Atlas, Vector CANTech, and Viewpoint.

#20
SciAutonics/ Auburn Engineering
 RED RASCAL
 Thousand Oaks, CA



SciAutonics LLC partnered with Auburn University to form a team comprised of scientists, engineers, and consultants bringing together various backgrounds and expertise.

Sponsors: Auburn University, Austrian Research Center, ESRI, and Phoenix International (parent of ATV Corporation).

#21
Team Oshkosh Truck
 TerraMax
 Oshkosh, WI



Team Oshkosh, formerly Team TerraMax in the 2005 Grand Challenge, has partnered with a new group of industry professionals and universities to take on the new challenge.

Sponsors: Auburn University, Caterpillar, IBED, Teledyne Scientific (formerly Rockwell Scientific), and University of Parma.

#23
Axion Racing
 Spirit
 Westlake Village, CA



Axion is a private research and development group dedicated to building autonomous vehicles. Axion Racing team members come from many different education and industry backgrounds providing a wide range of experience. Students from various California universities have also contributed to the effort.

Sponsors: Axion, LLC.

#24
Team CajunBot
 Cajunbot-II
 Lafayette, LA



University of Louisiana faculty, students, alumni, and friends have joined together their diverse education backgrounds and industry experience to create Team CajunBot.

Sponsors: CGC Technologies, Center for Advanced Computer Studies, Firefly, IBED, Iteris, Lafayette Motors, MEExpress Companies, and University of Louisiana Lafayette.

#26
Team Cornell
 Skynet
 Ithaca, NY



Team Cornell is comprised of students from Cornell University studying subjects ranging from mechanical engineering to computer science. Faculty members at Cornell University oversee these students and provide guidance and real world experience.

Sponsors: Advanced Circuits, Alpha Wire Company, General Motors, MOOG, Northrop Grumman, Septentric, SICK, ST Kinetics, The MathWorks, and Trimble.

#28
Team Case
 Dexter
 Cleveland, OH



Students, faculty, and alumni of Case Western Reserve University are building on the experience base from the former Team ENSCO and other supporting companies.

Sponsors: Argon ST, Bendix, Case Western Reserve University, Ensco, Glosser, Goodyear, National Instruments, NovAtel, Parker, QNX, and Ridge Road Auto Parts.

#30
Team Gray
 Plan B
 Metairie, LA



Team Gray consists of employees from GrayMatter, Inc., The Gray Insurance Company, and other subsidiaries from Gray & Company, Inc. as well as students from Tulane University and others from the general community. Their approach to the Urban Challenge builds upon the design policies that made them successful in 2005.

Sponsors: Electronic Mobility Controls, Gray Insurance Company, and Oxford Technical Solutions.

Urban Challenge Teams

#31
Team Juggernaut
 The Urban
 Juggernaut
 Sandy, UT



Team Juggernaut is comprised of experienced embedded systems and software developers with the support of independent professionals working to combine rugged systems design with cutting edge technology.

Sponsors: Bonneville Seabase, Castle Studios, CommStudio, DesignJug, FeatureCam, IronCAD, Kairos Autonomi, NovAtel, OmniSTAR, State of Utah, Utah Department of Transportation, VPI Engineering, and WestCAMP.

#32
VictorTango
 Odin
 Blacksburg,
 VA



VictorTango, from Virginia Tech, consists of undergraduate and graduate students and faculty, paired with a Virginia Tech autonomous systems spin-off company, Torc Technologies.

Sponsors: Black Box, Caterpillar, Ford, GM, Goodyear, Honeywell, IBED, Ingersoll Rand, Lockheed Martin, Michelin, National Instruments, NovAtel, OmniSTAR, QCI, SICK, Tripp-Lite, and Ultramotion.

#41
Princeton
 Prospect
 Eleven
 Princeton, NJ



Princeton undergraduates studying a variety of engineering disciplines make up the majority of this team. Assisting the young team are graduate students and faculty members.

Sponsors: Coleman, Delphi, FMC, Ford, FRABA-Posital, Gladiator Technologies, Inc., IEEE, OmniSTAR, Princeton University, Redgate Software, and Shock Tech.

#42
**Austin Robot
 Technology**
 Marvin the
 Land Robot
 Austin, TX



The Austin Robot Technology team brings together highly experienced programmers, engineers, scientists, and researchers. The team has partnered with the University of Texas at Austin students and faculty.

Sponsors: Advanced Micro Devices, Applanix, Arens, Auto Group, Enidine, Graftek Imaging, NavCom Technologies, SICK, Tyan, Ultramotion, and University of Texas at Austin.

#44
**Team
 Autonomous
 Solutions**
 Ted
 Petersboro, UT



Autonomous Solutions, Inc., Sarnoff Corporation, and DeVivo AST, Inc. have come together to form Team Autonomous Solutions, each combining their domain knowledge and expertise.

Sponsors: Applanix, Batelle, Freeport-McMoRan, OmniStar, Phytex, and SICK.

#46
**University of
 Utah**
 Ugo the Red Rover
 Salt Lake City, UT



Led by four professors from the University of Utah, the team brings together both graduate and undergraduate engineering students.

Sponsors: Cavati, NovAtel, and the University of Utah.

#47
Team-LUX
 LUX (the lynx)
 Woodstock, MD



Team-LUX is a small team of mostly Ibeo employees who are working with their parent company SICK. The team has partnered with Bishop Consulting, known for its expertise in intelligent vehicles.

Sponsors: Bishop Consulting, Ibeo Automobile Sensor, OmniSTAR, SICK, and Wildpark Schwarze Berge.

#49
**Team
 Cybernet**
 Cybervan
 Ann Arbor, MI



Led by Cybernet Systems Corporation, the team has joined with many companies and their employees to bring together a variety of perspectives and knowledge.

Sponsors: Applied Research Associates, Chrysler, Ford, Ideal Auto Restyling, Lawrence Technological Institute, Michigan Tech, Soar Technology, Sparton Corporation, Stewart and Stevenson, TARDEC, University of Detroit Mercy, and University of Michigan.

#50
**Georgia Tech/
 SAIC Sting
 Racing**
 Sting I
 Atlanta, GA



Students and researchers with multiple disciplines and backgrounds from Georgia Tech have joined with the experience of SAIC to form Sting Racing.

Sponsors: Duke University, Horizon Hobby, Jim Ellis Porsche, Mobile Intelligence, Robotics and Intelligent Machines, Seven Oaks Facilities, Sun Microsystems, and Telcordia.

Urban Challenge Teams

#54
Team AnnieWay
 AnnieWAY
 Palo Alto, CA



A group of professionals from several universities in Germany have joined to form Team AnnieWay, a spin-off from the Collaborative Research Center on Cognitive Automobiles.

Sponsors: Fraunhofer IITB, Ohio State University, Technische Universitat Munchen, Universitat det Bundeswehr (Munich), and Universitat Karlsruhe (TH).

#55
Ody-Era
 Ody-Era
 Kokomo, IN



The dedicated team of Ody-Era combines experience in critical applications for defense vehicles and all-terrain vehicle design and fabrication with software and state of the art expertise.

Sponsors: Addco, AGR, Converse, CSI Electronics, Delphi, Lowe Racing Engines, Mac's Shop, Moton Suspension Technology, Papa's Italian Bistro, RoboteQ, Stoeller Automation, and US Digital.

#62
CarOLD
 Caroline
 New York, NY



Students, faculty, and employees of five different Institutes of the Braunschweig University of Technology have joined their knowledge, skill, and expertise to form CarOLD.

Sponsors: IAV GmbH, Ibeo, Innovations Gesellschaft Technische Universitat Braunschweig, OmniSTAR, Phoenix Contact, SMS GmbH, Zentrum fur Mechatronik,

#65
AvantGuardium
 RONIN
 Fort Worth, TX



The AvantGuardium team is formed by United States and Israeli defense technology groups for the development of unmanned ground vehicles. Group members bring highly experienced professionals in the areas of robotics, control, computer vision, artificial intelligence, and systems engineering.

Sponsors: EFW, Inc., part of Elbit Systems of America Company.

#71
Team Berlin
 RUFUS
 Houston, TX



Team Berlin's core members are undergraduate and graduate students and researchers from Freie Universitat Berlin. They have partnered with the Fraunhofer Society, Rice University, and the Universidad de Monterrey.

Sponsors: Applanix, Basler, Berlin Sciences, Beyo, Faulhaber Motoren, JVC, Ibeo, IBM Deutschland, and Micro-Epsilon.

#74
Ben Franklin Racing Team
 Ben
 Philadelphia, PA



Students and faculty from University of Pennsylvania and Lehigh University have paired their education and knowledge with the skills and expertise of Lockheed Martin employees.

Sponsors: Lehigh University, Lockheed Martin, Oxts, Thales, and the University of Pennsylvania.

#78
Team Urbanator
 Rocky
 Littleton, CO



Team Urbanator, made up of employees from PerceptTek, is integrating and refining the enabling technologies which will allow any vehicle to operate autonomously. PerceptTek is leveraging its overall software perception, planning and control architecture for autonomous road driving. PerceptTek also brings its previous Grand Challenge 2 and Mobile Autonomous Robotic Software (MARS) 2020 project experience.

Sponsors: Perceptek Robotics.

#79
MIT
 Talos
 Cambridge, MA

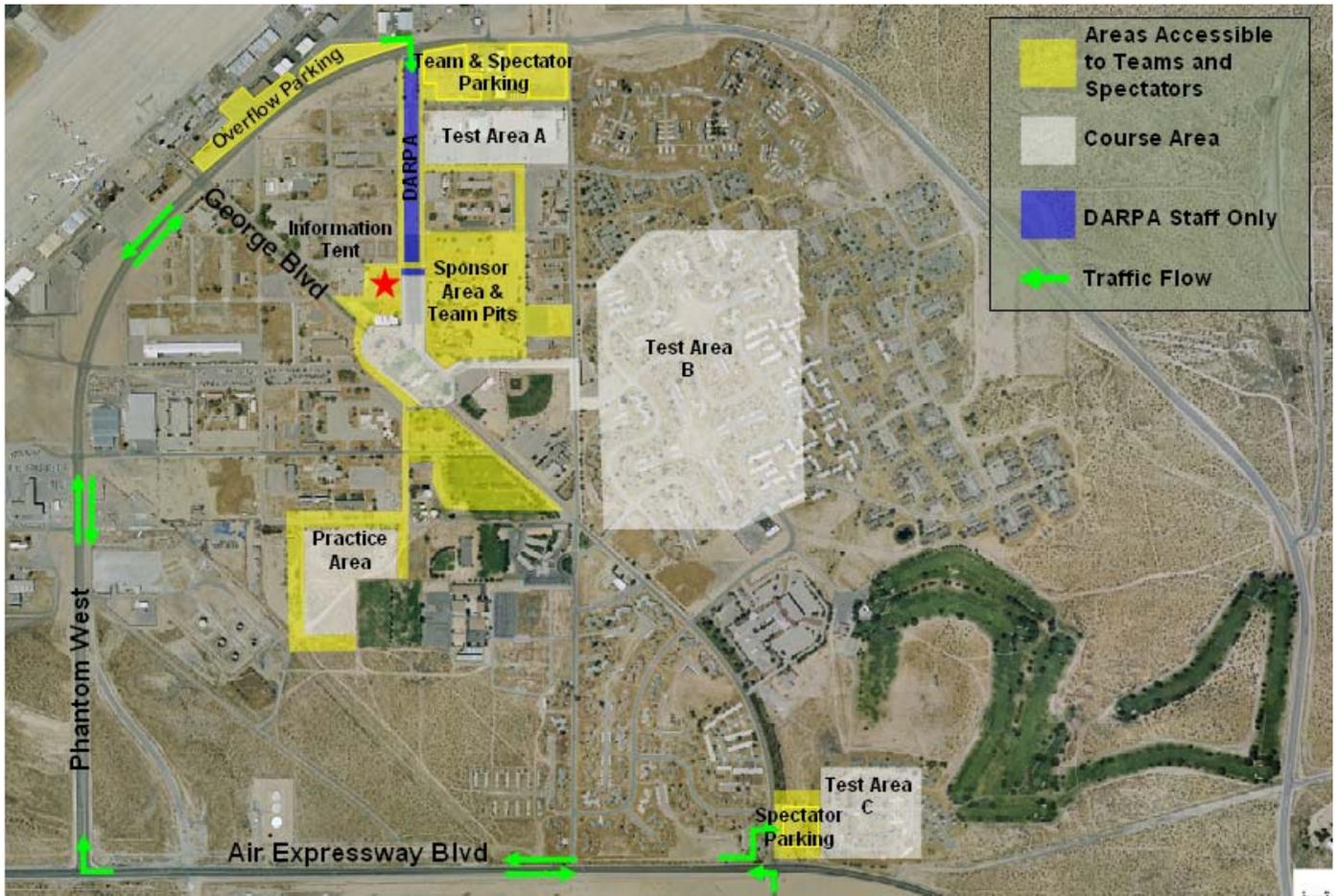


Students and faculty from MIT have joined with undergraduates from Olin college and engineers from Draper Laboratory to take on the Challenge. The team will exploit its strengths in perception, planning, navigation, and control.

Sponsors: Acumentrics, Advanced Circuits, Applanix, BAE Systems, Charles Stark Draper Laboratory, Delphi, Drew Technologies, Ford, MIT, Mobileye, Nokia Research Center, Olin College, and Quanta Computer.



URBAN CHALLENGE



National Qualification Event

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The National Qualification Event (NQE) is the final qualification round. The 35 teams are each given an opportunity to demonstrate the capabilities of their vehicle at three Test Areas. Spectators are welcome to observe the testing process and follow the progress of the vehicles as they operate in moving traffic, make decisions at intersections, and demonstrate many of the skills required of human drivers. The testing schedule is posted each day in the Information Tent. The final results of this evaluation will be announced on November 1 in the Event Tent.

Testing

Vehicles will be tested at Areas A, B, and C, shown on the map above. Approximately seven robotic vehicles will be tested in each area during a morning or an afternoon block. The order of the teams competing in each area is available in the Information Tent.

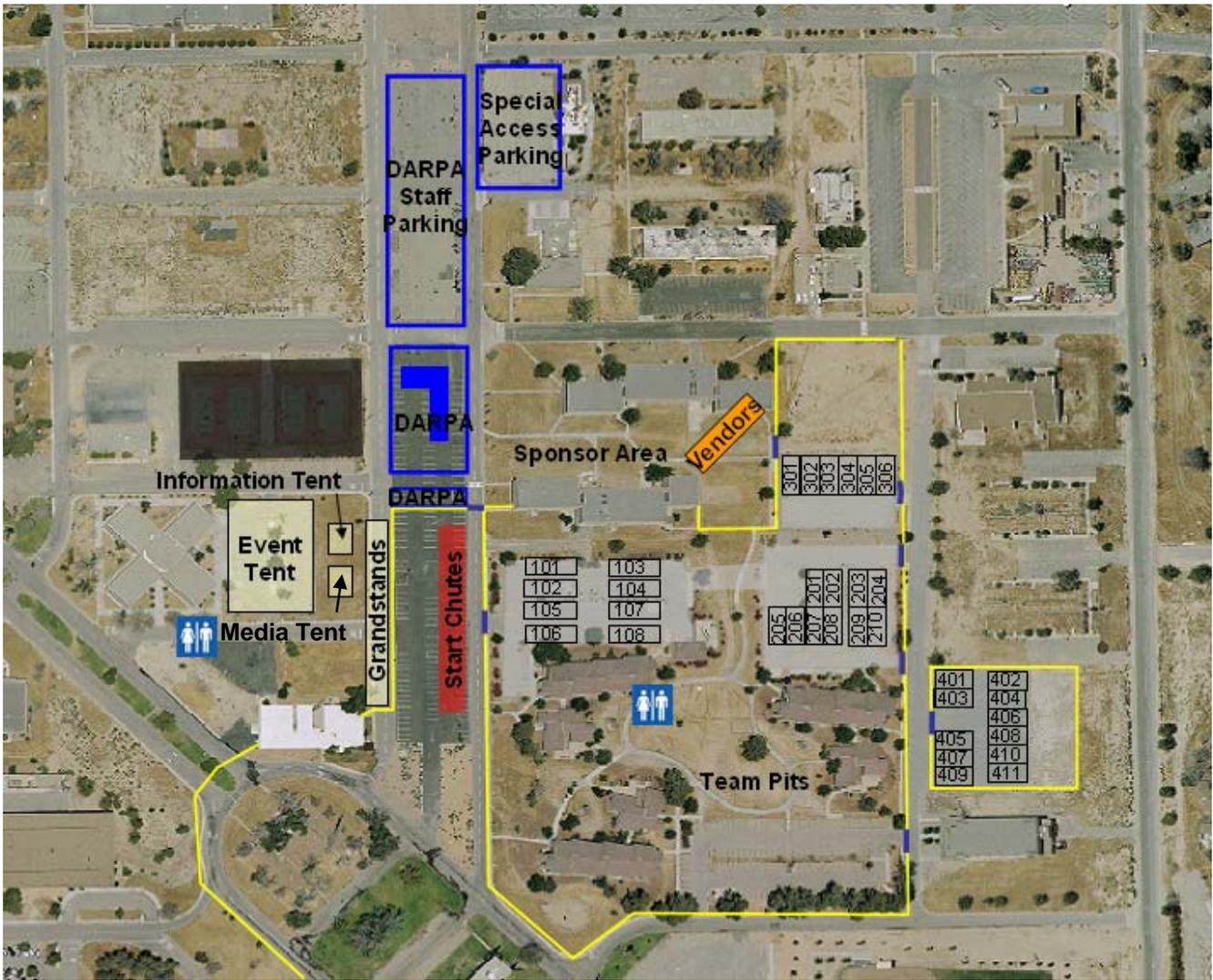
At Test Area A, vehicles will be evaluated on their ability to operate with live traffic. Vehicles attempt to make a safe left turn across moving traffic, and to pull out at a T-intersection with cars arriving from both directions. At Area B, vehicles are tested for speed on a course that includes narrow winding roads with parked cars and obstructions that

they have to navigate safely. Vehicles must also perform a parking maneuver into a designated parking spot. At Area C, vehicles are tested on their ability to operate correctly at 4-way intersections and to find another way to their destination when the road in front of them is blocked. In all areas, vehicles are given a computerized map of the course and checkpoints they must pass to complete their test.

Traffic Vehicles

There are human-operated traffic vehicles on the course. The traffic vehicles are specially equipped with safety seats and crash cages.





Spectator Information

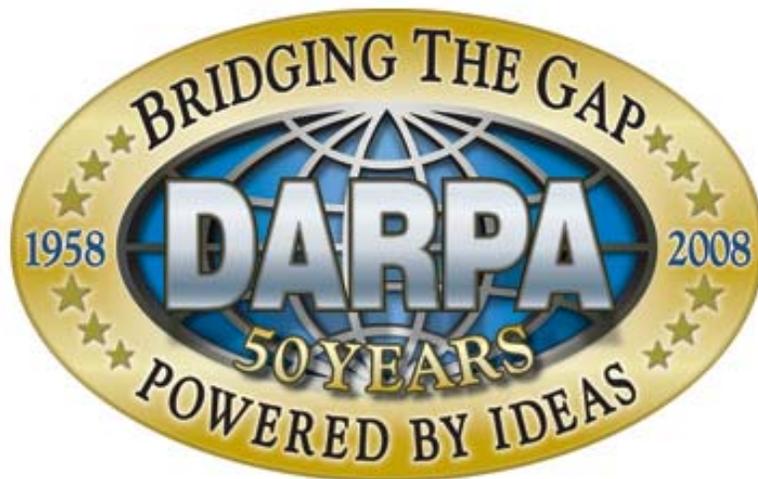
The event is free and open to the public. During NQE, spectators may view Area A testing activities from outside the perimeter fence and behind the safety barriers. The grandstands near the Start Area are ideal for viewing vehicle starts for Area B. Spectators may also view the vehicles from around the traffic circle as they head onto the course. Limited viewing opportunities exist at Area C, including vehicle performance at a 4-way stop.

During the Urban Challenge event on November 3rd, the grandstands are the ideal location to view autonomous vehicles starting the course, conducting a mission, then returning to start a new mission. On George Boulevard autonomous vehicles will merge into traffic and attempt to pass one another. There will be live video from the course on big screens in the Event Tent where spectators can follow the progress of the vehicles.

Team Pits

The team pits will be open for limited hours during NQE to enable spectators to view the robotic teams up close as the teams prepare for competition.

- | | |
|-------------------------------------|--------------------------------|
| 101: Team Caltech | 210: OSU-ACT |
| 102: Austin Robot Technology | 301: Team Oshkosh Truck |
| 103: Stanford Racing Team | 302: Team Autonomous Solutions |
| 104: Georgia Tech/SAIC Sting Racing | 303: VictorTango |
| 105: Team Cybernet | 304: MIT |
| 106: Team Case | 305: Ben Franklin Racing Team |
| 107: Team Berlin | 306: Tartan Racing |
| 108: Team-LUX | 401: Princeton University |
| 201: Gator Nation | 402: Team UCF |
| 202: SciAutonics/Auburn Engineering | 403: Team Juggernaut |
| 203: OdyEra | 404: Honeywell/IVS Team |
| 204: AvantGuardium | 405: Team Urbanator |
| 205: Team Gray | 406: Team Cornell |
| 206: Team CajunBot | 407: The Golem Group |
| 207: Axion Racing | 408: Mojávaton |
| 208: University of Utah | 409: Team Jefferson |
| 209: Insight Racing | 410: Team AnnieWay |
| | 411: CarOLO |



URBAN CHALLENGE

www.darpa.mil/grandchallenge