

**WinterGreen Research, INC.**

**Robot Cars and Trucks: Market Shares, Strategies, and Forecasts,  
Worldwide, 2013 to 2019**

**Robot Cars and Trucks Providing a Flexible, Convenient System For  
Automating Vehicles**

**Mountains of Opportunity**



Picture by Susan Eustis

**WinterGreen Research, Inc.**

**Lexington, Massachusetts**

[www.wintergreenresearch.com](http://www.wintergreenresearch.com)

781 853 5078

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

**CHECK OUT THESE KEY TOPICS**

**Robot Cars and Trucks**  
Robot steering  
Robot breaking  
Robot automotive systems  
Autonomous functions for vehicles

**Collision avoidance**  
Automated parking  
Robot Parking  
Robot test driving  
Car cameras  
Truck follow me systems

**Radar based monitoring systems**  
Lane assist  
Adaptive cruise control

**Robot Cars and Trucks Growth Strategy:**

**Robot Cars and Trucks: Market Shares, Strategies, and Forecasts, Worldwide, 2013-2019**

LEXINGTON, Massachusetts (October 25, 2013) – WinterGreen Research announces that it has published a new study **Robot Cars and Trucks: Market Shares, Strategy, and Forecasts, Worldwide, 2013 to 2019**. The 2013 study has 362 pages, 144 tables and figures. Worldwide markets are poised to achieve significant growth as robot cars and trucks permit users to implement automated driving.

IBM and Google are sure to be a significant software vendors for all the robot car and truck market participants. IBM has a huge head start with its excellent middleware branded integrated solutions that are hardened and reliable.

As automated process hits the auto industry as a disruptive force, it parallels the automated piloting of the airline industry that saw significant labor savings implementation. Automated vehicle driving can be done anywhere just by connecting the car to the adaptive cruise control, adaptive steering and braking, and lane assist systems.

Robot cars and trucks incrementally add automated process to driving. As software is added to cars and trucks it is done in concert with modification to the steering, breaking, and other automotive systems. Autonomous functions for vehicles are increasingly adopted.

Change is incremental, we do not have fully functioning robot cars immediately, rather, steering, collision avoidance, parking, test driving, series of camera and radar based monitoring systems, lane assist, and adaptive cruise control are being implemented, presaging rapid adoption of robot cars and trucks as the various functions mature and work in the real world.

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

## WinterGreen Research, INC.

According to Susan Eustis, team leader for the preparation of the study, "The market for robot car and truck vehicles is anticipated to expand in parallel with the deployment of appropriate roadway controls funded by government programs. The large public investments for robot vehicles so far has been for development of technology that works for military purposes."

The robot car designs amalgamate a group of features to represent an automated process solution. These include the hardware, the software middleware, the steering system, adaptive cruise control, numerous software applications, an integrated systems approach, and related services. Significant investments in research and development are necessary as the emerging robot cars and trucks industry builds on incremental technology roll outs.

Robot car and truck commercial autonomous car market shipments forecasts indicate that markets beginning to develop in 2014 will rise to \$3.6 billion by 2019. Growth is a result of various moves toward autonomous vehicles that park themselves, provide automated steering, are used as test vehicles, are used as mapping vehicles, and that provide driver alerts but fall sort of complete robotically operated car vehicles.

Market driving forces relate primarily to the need for increased safety and personalization for autos. Car manufacturers are positioning with robot car models to meet demand at the high end. Many robot vehicle car vendors are making automation for personal vehicles and trucks a reality.

WinterGreen Research is an independent research organization funded by the sale of market research studies all over the world and by the implementation of ROI models that are used to calculate the total cost of ownership of equipment, services, and software. The company has 35 distributors worldwide, including Global Information Info Shop, Market Research.com, Research and Markets, electronics.ca, Bloomberg, and Thompson Financial.

WinterGreen Research is positioned to help customers face challenges that define the modern enterprises. The increasingly global nature of science, technology and engineering is a reflection of the implementation of the globally integrated enterprise. Customers trust WinterGreen Research to work alongside them to ensure the success of the participation in a particular market segment.

WinterGreen Research supports various market segment programs; provides trusted technical services to the marketing departments. It carries out accurate market share and forecast analysis services for a range of commercial and government customers globally. These are all vital market research support solutions requiring trust and integrity.

This robot car and truck shipment analysis is based on consideration of the metrics for the number of cars shipped, percent of cars outfitted with automated cruise control, and probable market penetrations of robot cars. Experience using the robot cars and trucks is another factor that contributes to development of triangulation regarding market forecasts for the sector.

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

Key Words: Robot Cars and Trucks, Robot Cars and Trucks, Robot steering, Robot breaking, Robot automotive systems, Autonomous functions for vehicles , Collision avoidance, Automated parking, Robot Parking, Robot test driving, Car cameras, Truck follow me systems, Radar based monitoring systems, Lane assist, Adaptive cruise control

## Companies Profiled

### Market Leaders

Google  
BMW  
Daimler AG/Mercedes-Benz  
General Dynamics  
GM  
Kairos  
Mitsubishi

Ford  
Tesla  
Fuji  
Lockheed Martin  
iRobot  
Nissan  
Toyota

### Market Participants

Allen Vanguard  
Audi  
BAE Systems  
Boston Dynamics  
Bosch Group  
Evatran Group  
BMW  
Buick Group  
Chrysler / Dodge  
Daimler AG/Mercedes-Benz  
ECA Robotics  
Elbit Systems

Evatran Group  
Ford / Lincoln  
Fuji Heavy Industries / Subaru  
General Dynamics  
Google Self-Driving Car  
GM / Cadillac  
iRobot Revenue  
Kairos Autonomi  
Kongsberg  
Jaguar Land Rover  
Lockheed Martin  
Mesa Robotics

Mitsubishi  
Nissan  
Qualcomm  
Thales Group  
Toyota / Lexus  
Vecna Technologies  
Volkswagen / Porsche  
Volvo  
Visteon  
WiTricity

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

**Robot Cars and Trucks: Market Shares, Strategies, and Forecasts,  
Worldwide, 2013 to 2019**

**Report Methodology**

This is the 574th report in a series of primary market research reports that provide forecasts in communications, telecommunications, the Internet, computer, software, telephone equipment, health equipment, and energy. Automated process and significant growth potential are a priority in topic selection. The project leaders take direct responsibility for writing and preparing each report. They have significant experience preparing industry studies.

They are supported by a team, each person with specific research tasks and proprietary automated process database analytics. Forecasts are based on primary research and proprietary data bases.

The primary research is conducted by talking to customers, distributors and companies. The survey data is not enough to make accurate assessment of market size, so WinterGreen Research looks at the value of shipments and the average price to achieve market assessments. Our track record in achieving accuracy is unsurpassed in the industry. We are known for being able to develop accurate market shares and projections. This is our specialty.

The analyst process is concentrated on getting good market numbers. This process involves looking at the markets from several different perspectives, including vendor shipments. The interview process is an essential aspect as well. We do have a lot of granular analysis of the different shipments by vendor in the study and addenda prepared after the study was published if that is appropriate.

Forecasts reflect analysis of the market trends in the segment and related segments. Unit and dollar shipments are analyzed through consideration of dollar volume of each market participant in the segment. Installed base analysis and unit analysis is based on interviews and an information search. Market share analysis includes conversations with key customers of products, industry segment leaders, marketing directors, distributors, leading market participants, opinion leaders, and companies seeking to develop measurable market share.

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

## WinterGreen Research, INC.

Over 200 in depth interviews are conducted for each report with a broad range of key participants and industry leaders in the market segment. We establish accurate market forecasts based on economic and market conditions as a base. Use input/output ratios, flow charts, and other economic methods to quantify data. Use in-house analysts who meet stringent quality standards.

Interviewing key industry participants, experts and end-users is a central part of the study. Our research includes access to large proprietary databases. Literature search includes analysis of trade publications, government reports, and corporate literature.

Findings and conclusions of this report are based on information gathered from industry sources, including manufacturers, distributors, partners, opinion leaders, and users. Interview data was combined with information gathered through an extensive review of internet and printed sources such as trade publications, trade associations, company literature, and online databases. The projections contained in this report are checked from top down and bottom up analysis to be sure there is congruence from that perspective.

The base year for analysis and projection is 2011. With 2011 and several years prior to that as a baseline, market projections were developed for 2012 through 2018. These projections are based on a combination of a consensus among the opinion leader contacts interviewed combined with understanding of the key market drivers and their impact from a historical and analytical perspective.

The analytical methodologies used to generate the market estimates are based on penetration analyses, similar market analyses, and delta calculations to supplement independent and dependent variable analysis. All analyses are displaying selected descriptions of products and services.

This research includes referencde to an ROI model that is part of a series that provides IT systems financial planners access to information that supports analysis of all the numbers that impact management of a product launch or large and complex data center. The methodology used in the models relates to having a sophisticated analytical technique for understanding the impact of workload on processor consumption and cost.

WinterGreen Research has looked at the metrics and independent research to develop assumptions that reflect the actual anticipated usage and cost of systems. Comparative analyses reflect the input of these values into models.

The variables and assumptions provided in the market research study and the ROI models are based on extensive experience in providing research to large enterprise organizations and data centers. The ROI models have lists of servers from different manufacturers, Systems z models from IBM, and labor costs by category around the world.

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

## WinterGreen Research, INC.

This information has been developed from WinterGreen research proprietary data bases constructed as a result of preparing market research studies that address the software, energy, healthcare, telecommunications, and hardware businesses.

### YOU MUST HAVE THIS STUDY

#### Table of Contents

# Robot Cars and Trucks: Market Shares, Strategy, and Forecasts, 2013 to 2019

## Table of Contents

### Robot Cars and Trucks Executive Summary

The study is designed to give a comprehensive overview of Robot Cars and Trucks equipment market segment. Research represents a selection from the mountains of data available of the most relevant and cogent market materials, with selections made by the most senior analysts. Commentary on every aspect of the market from independent analysts creates an independent perspective in the evaluation of the market. In this manner the study presents a comprehensive overview of what is going on in this market, assisting managers with designing market strategies likely to succeed.

#### Table of Contents

<b>ROBOT CARS AND TRUCKS EXECUTIVE SUMMARY</b>	<b>23</b>
Robot Car and Truck Market Driving Forces	23
Robot Car and Truck Market Shares	26
Robot Car and Truck Market Forecasts	28

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

## Robot Cars and Trucks Market Definition And Market Dynamics

<b>1. ROBOT CARS AND TRUCKS MARKET DEFINITION AND MARKET DYNAMICS</b>	<b>30</b>
1.1 Robot Cars And Trucks Global Markets	30
1.1.1 Robot Cars And Trucks Operations And Performance	32
1.1.2 Robot Cars And Trucks Business and Technology Trends	32
1.1.3 Wireless Car Charging	32
1.1.4 Vehicle Sharing	34
1.2 Auto Industry	35
1.2.1 Robot Cars And Trucks Economic Forces	36
1.2.2 Cars Represent 20% Of The US Economic Retail Spending	36
1.3 Robot Cars And Trucks Design Trajectories	37
1.4 Robot Cars And Trucks EVs	37
1.4.1 Robot Cars And Trucks Cost Effective In City Conditions	38
1.4.2 Lithium-Ion Car Batteries	39
1.4.3 Private-Public Partnerships	40
1.5 Lithium-Ion Battery Target Markets	41
1.6 UGV Enabling Technologies	42
1.6.1 Sensor Processing	43
1.6.2 Machine Autonomy	44
1.7 Military Robot Follow-Me Capability	44
1.7.1 UGV Follow-Me Capability	45
1.7.2 Communications Bandwidth	45
1.7.3 Battery Power	46
1.7.4 Combination Of Batteries Linked To Onboard Conventional Diesel	46
1.7.5 SUGVs	46
1.7.6 Mid-Size Category UGV	47
1.7.7 Large UGV	48

## Robot Cars and Trucks Market Shares And Market Forecasts

<b>2. ROBOT CARS AND TRUCKS MARKET SHARES AND MARKET FORECASTS</b>	<b>50</b>
2.1 Robot Car and Truck Market Driving Forces	50
2.2 Robot Car and Truck Market Shares	53
2.2.1 General Dynamics Robotic Systems	55
2.2.2 General Dynamics Mobile Detection	56
2.2.3 General Dynamics Tactical Autonomous Combat – Chassis (TAC - C)	58



# WinterGreen Research, INC.

2.2.4	Google Self-Driving Car	59
2.2.5	Google Self-Driving Car from Auto Components	60
2.2.6	Northrop Grumman	60
2.2.7	Northrop Grumman Cutlass	61
2.2.8	Northrop Grumman Mini-ANDROS II	61
2.2.9	IBM 62	
2.2.10	IBM / Ford Automotive Vehicle System M2M	63
2.2.11	Ford Robotically Controlled Vehicles On Test Track	64
2.2.12	Toyota Production LS 2013 Model Self-Driving Tools Technology	64
2.2.13	Hyundai Genesis Smart Cruise Control	65
2.2.14	Nissan	65
2.2.15	BMW	65
2.2.16	Daimler AG / Mercedes-Benz Self Driving Car	65
2.2.17	GM Chevrolet Impala 2014	66
2.2.18	Kairos Autonami Pronto4	67
2.3	Robot Car and Truck Market Forecasts	68
2.3.1	Automotive Market Discussion	71
2.3.2	Electric Vehicle EV Market Forecasts and Installed Base	73
2.3.3	Electric Vehicle EV Market Forecasts	75
2.3.4	Discussion of Various Size Military Robot Market Strengths and Challenges	78
2.3.5	Larger Military Robot Forecasts	78
2.3.6	Trends in the Auto Industry that Will Be Present in the Military Robot Industry	80
2.3.7	Unmanned Ground Systems Roadmap	82
2.3.8	Robots Represent Modernization of Military	84
2.3.9	Commercial Car Adaptive Cruise Control	84
2.4	Robot Car and Truck Regional Market Segments	85
2.4.1	Ford North America	85
2.4.2	Ford South America	88
2.4.3	Ford Europe	88
2.4.4	Ford Asia Pacific Africa	90
2.4.5	Military Robot Regional Analysis	91
2.5	Military Ground Robot Installed Base and Shipments Market Forecasts	93

## Robot Cars and Trucks Product Description

<b>3. ROBOT CARS AND TRUCKS PRODUCT DESCRIPTION</b>	<b>94</b>
3.1 Google	94
3.2 IBM / Ford	96
3.2.1 IBM / Ford Automotive Vehicle System M2M	97
3.2.2 Ford Leveraging IBM Partnership, Using Sensors	99
3.2.3 IBM Smarter Planet Strategy	99
3.3 Ford Self Driving Car	100
3.3.1 Ford Robotic Auto Control System	101
3.3.2 Ford Adaptive Cruise Control	102
3.4 Nissan	103
3.4.1 Nissan EPORO Robot Car	104
3.5 GM / Cadillac	108

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

3.6	Toyota	112
3.7	Audi	117
3.8	Daimler AG / Mercedes-Benz	118
3.9	Volkswagen	120
3.10	Volvo	123
3.11	BMW	125
3.11.1	BMW Partially Automated Driving Functions	126
3.11.2	BMW Autonomous Car Safety Features	127
3.12	Subaru Adaptive Cruise Control	127
3.13	Honda	130
3.14	Hyundai Genesis Smart Cruise Control	133
3.15	Jaguar Adaptive Cruise Control	135
3.16	Land Rover	135
3.16.1	Land Rover Smart Driver Assistance Technologies	136
3.16.2	Land Rover Reverse Traffic Detection	137
3.16.3	Land Rover Electric Power-Assisted Steering with Park Assist	138
3.16.4	Land Rover Powerful Braking With Lightweight Brembo Calipers	140
3.16.5	Land Rover Enhanced Active Safety Technologies	141
3.16.6	Land Rover Engineered for Maximum Occupant Protection	143
3.17	Lexus Adaptive Cruise Control	145
3.18	Lincoln	146
3.18.1	Lincoln Adaptive Cruise Control	146
3.18.2	Lincoln Active Park Assist	146
3.18.3	Lincoln Lane-Keeping System	147
3.18.4	Lincoln Intelligent Access with Push-Button Start	147
3.18.5	Lincoln BLIS® with Cross-Traffic Alert	147
3.19	Porsche	147
3.20	Buick LaCrosse 2014	149
3.21	GM Chevrolet Impala 2014	150
3.21.1	GM Safety Technology	150
3.22	Chrysler 300 SRT8	152
3.22.1	Chrysler Technology Recognizes When Things Slow Down	152
3.22.2	Chrysler Backup, Safety & Security	153
3.23	Dodge Durango 2014	154
3.24	Kongsberg CORTEX	156
3.25	BAE Systems Land Vehicles Given a Brain of their Own	157
3.26	Kairos Autonomi Pronto4 Retrofitting System for Existing Vehicles or Vessels	159
3.26.1	Kairos Pronto4™ Agnostic Autonomy System Features	161
3.26.2	Kairos ProntoMimic Software Suite	161
3.27	Lockheed Martin SMSS	162
3.27.1	Lockheed Martin SMSS User-Proven Autonomy	164
3.27.2	Lockheed Martin SMSS Unmanned Capabilities	164
3.28	General Dynamics Robotic Systems	164
3.28.1	General Dynamics Mobile Detection Assessment and Response System (MDARS)	169
3.28.2	General Dynamics Tactical Autonomous Combat – Chassis (TAC - C)	171

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

## Robot Cars and Trucks Technology

<b>4. ROBOT CARS AND TRUCKS TECHNOLOGY</b>	<b>173</b>
4.1 MIT Demonstrates Swarm Of Modular Robots That Self-Assemble Into Larger Shapes	173
4.2 Robotic Car Fish-Inspired Technology	173
4.3 Adaptive Cruise Control (ACC)	175
4.3.1 Distance Measured By A Small Radar Unit	176
4.4 ACC Technology	176
4.4.1 Adaptive Cruise Control	177
4.4.2 Lexus_IS250_ACC Adaptive Cruise Control	178
4.5 Advanced Robot Technology: Navigation, Mobility, And Manipulation	179
4.5.1 Robot Intelligence Systems	180
4.5.2 Real-World, Dynamic Sensing	180
4.6 User-Friendly Interfaces	181
4.6.1 Tightly-Integrated, Electromechanical Robot Design	181
4.7 Field Based Robotics Iterative Development	182
4.7.1 Next-Generation Products Leverage Model	182
4.7.2 Modular Robot Structure And Control	183
4.7.3 Lattice Architectures	183
4.7.4 Chain / Tree Architectures	183
4.7.5 Deterministic Reconfiguration	184
4.7.6 Stochastic Reconfiguration	184
4.7.7 Modular Robotic Systems	184
4.8 Intel Military Robot Cultivating Collaborations	185
4.9 Hitachi Configuration Of Robots Using The SuperH Family	185
4.9.1 Hitachi Concept of MMU And Logic Space	186
4.9.2 Robotic Use of Solid State Thin Film Lithium-Ion Batteries	191
4.10 Network Of Robots And Sensors	191
4.10.1 Sensor Networks Part Of Research Agenda	193
4.10.2 Light Sensing	194
4.10.3 Acceleration Sensing	194
4.10.4 Chemical Sensing	195
4.11 Military Robot Technology Functions	195
4.12 Carbon Nanotube Radio	196
4.13 Military Robot Funded Programs	197
4.13.1 Army Brigade Combat Team Modernization	197
4.13.2 XM1216 Small Unmanned Ground Vehicle (SUGV)	198
4.13.3 UUV Sub-Pillars	199
4.13.4 Hovering Autonomous Underwater Vehicle (HAUV)	201
4.13.5 Alliant	201
4.13.6 ATSP is a Government-Wide Contracting Vehicle	202
4.13.7 Quick, Efficient Contracting Vehicle	203
4.13.8 Facilitates Technology And Insertion Into Fielded Systems	203
4.13.9 Access to All Northrop Grumman Sectors	203
4.14 iRobot Technology	203
4.14.1 iRobot AWARE Robot Intelligence Systems	204
4.14.2 iRobot Real-World, Dynamic Sensing.	204

# WinterGreen Research, INC.

4.14.3	iRobot User-Friendly Interface	205
4.14.4	iRobot Tightly-Integrated Electromechanical Design.	205
4.15	Evolution Robotics Technology Solutions	205
4.16	Military Robot Technology Enablers	208
4.16.1	Military Robot Logistics	210
4.17	MRAP ATV: Requirements and Contenders	211
4.18	Military Robot Enabling Technology	217
4.19	Intel Integrated Circuit Evidence-Based Innovation	219
4.19.1	Open Robotic Control Software	221
4.19.2	Military Robot Key Technology	222

## Robot Cars and Trucks Company Description

<b>5. ROBOT CARS AND TRUCKS COMPANY DESCRIPTION</b>	<b>225</b>	
5.1	Allen Vanguard	225
5.1.1	Allen Vanguard Rapid Development	227
5.2	Audi	231
5.2.1	Audi Gets The Second Driverless Car Permit In Nevada	232
5.3	BAE Systems	232
5.4	Boston Dynamics	236
5.4.1	Boston Dynamics LS3 - Legged Squad Support Systems	237
5.4.2	Boston Dynamics CHEETAH - Fastest Legged Robot	238
5.4.3	Boston Dynamics Atlas - The Agile Anthropomorphic Robot	240
5.4.4	Boston Dynamics BigDog	242
5.4.5	Boston Dynamics LittleDog - The Legged Locomotion Learning Robot	243
5.5	Bosch Group	245
5.5.1	Evatran Group Plugless Sales Go Live with Bosch	245
5.5.2	Bosch Business Overview	246
5.5.3	Bosch Group Reorganized Its Business Sectors	247
5.1.1	Bosch Consumer Goods sales	249
5.1.2	Bosch Automotive Technology sales	249
5.1.3	Bosch Industrial Technology Sales	250
5.1.4	Bosch Group	251
5.1.5	Bosch Healthcare Supports Independent Living At Home	251
5.1.6	Bosch Security Systems Division	252
5.1.7	Robert Bosch Healthcare	252
5.1.8	Robert Bosch Remote Patient Monitoring	253
5.1.9	Bosch Healthcare Telehealth Systems	254
5.1.10	Bosch Healthcare Health Buddy System	255
5.1.11	Bosch Addresses Role of Compliance in Telehealth Adoption	256
5.1.12	Bosch North America Veterans Health Administration	256
5.1.13	Bosch / VRI	259
5.1.14	Bosch Healthcare and GreatCall Partnership	259
5.1.15	Bosch Healthcare - Telehealth And Care Solutions Join To Become The Leading Provider Of Health, Safety, And Communication	260
5.1.16	Bosch Group and Health Hero Network	261

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

5.6	BMW	262
5.6.1	BMW Strategy	262
5.6.2	BMW Revenue	263
5.7	Buick Group	264
5.8	Chrysler / Dodge	265
5.8.1	Chrysler Revenue	266
5.9	Daimler AG/Mercedes-Benz	266
5.9.1	Daimler AG Revenue	267
5.10	ECA Robotics	268
5.11	Elbit Systems	269
5.11.1	Elbit Systems Principal Market Environment	270
5.11.2	Elbit Systems	271
5.11.3	Elbit Systems Principal Market Environment	272
5.12	Evatran Group	274
5.13	Ford / Lincoln	274
5.13.1	Ford Business	274
5.13.2	Ford Motor Vehicle Fuel Economy	277
5.13.3	Ford Revenue	277
5.14	Fuji Heavy Industries / Subaru	278
5.14.1	Subaru Automotive Business	278
5.14.2	Subaru of America	279
5.15	G-NIUS 279	
5.16	General Dynamics	280
5.16.1	Sequester Mechanism	281
5.16.2	General Dynamics Revenue	281
5.16.3	General Dynamics Robotic Systems	282
5.16.4	General Dynamics Robotic Systems (GDRS) Vision	282
5.16.5	General Dynamics Robotic Systems (GDRS) Manufacturing	283
5.16.6	General Dynamics Autonomous Land And Air Vehicle Development	283
5.17	Google Self-Driving Car	284
5.17.1	Google Cars Address Vast Majority Of Vehicle Accidents Due To Human Error	286
5.17.2	Google Business	286
5.1.17	Google 2012 Corporate Highlights	287
5.17.3	Google Search	288
5.1.18	Google Revenue	290
5.1.19	Google Second Quarter 2013 Results	290
5.1.20	Google Revenues by Segment and Geography	293
5.1.21	Google / Motorola Headcount	294
5.1.22	Google / Motorola	294
5.18	GM / Cadillac	295
5.18.1	GM Business	296
5.18.2	GM Strategy	297
5.18.3	GM Revenue	298
5.19	Honda	299
5.20	Hyundai	301
5.21	iRobot	302
5.21.1	iRobot Home Robots:	302
5.21.2	iRobot Defense and Security: Protecting Those in Harm's Way	302
5.21.3	iRobot Role In The Robot Industry	303

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

5.21.4	iRobot SPARK (Starter Programs for the Advancement of Robotics Knowledge)	303
5.21.5	iRobot Revenue	304
5.21.6	iRobot Acquires Evolution Robotics, Inc.	305
5.21.7	iRobot / Evolution Robotics	306
5.22	Kairos Autonomi	306
5.22.1	Kairos Autonomi Autonomy ROI	306
5.22.2	Kairos Autonomi Upgrades Robot Conversion Kit	307
5.23	Kongsberg	307
5.24	Jaguar Land Rover	308
5.25	Lockheed Martin	309
5.25.1	Lockheed Martin Symphony Improvised Explosive Device Jammer Systems	312
5.25.2	Lockheed Martin Aeronautics Revenue	312
5.25.3	Lockheed Martin Electronic Systems	317
5.25.4	Lockheed Martin	318
5.26	Mesa Robotics	318
5.26.1	Systems Development Division of Mesa Associates	318
5.26.2	Mesa Robotics Affordable Robotic Solutions	320
5.26.3	Mesa Robotics Revenue	321
5.27	Mitsubishi	321
5.28	Nissan	322
5.28.1	Nissan Revenue	323
5.29	Qualcomm	324
5.29.1	Qualcomm Business	324
5.29.2	QMC Offers Comprehensive Chipset Solutions	325
5.29.3	Qualcomm Government Technologies	326
5.29.4	Qualcomm Internet Services	327
5.29.5	Qualcomm Ventures	328
5.29.6	Qualcomm Revenue	330
5.29.7	Qualcomm / WiPower	331
5.29.8	Qualcomm Standardization Capabilities	332
5.29.9	Qualcomm Regulatory and Compliance Capabilities	332
5.30	Thales Group	332
5.30.1	Thales Core Businesses	333
5.30.2	Thales: - A Global Player	333
5.30.3	Thales Revenue	335
5.30.4	Thales Key Technology Domains	335
5.30.5	Thales Open Research	336
5.30.6	Thales Stance on Environment	336
5.30.7	Thales Product Design	337
5.30.8	Thales Site Management	337
5.30.9	Thales Alenia Space Integration Of Service Module For The Fourth ATV	338
5.30.10	Thales Sonar 'Excels' In Anti-Submarine Warfare Exercise	339
5.30.11	Thales Group Ground Alerter 10	340
5.30.12	Thales Group Ground Master 400 (GM 400)	341
5.30.13	Thales Group Ground Smarter 1000	342
5.30.14	Thales Group	343
5.31	Toyota / Lexus	345
5.31.5	Toyota	345
5.23.1	Toyota Avalon Wireless Charging Pad	345
5.23.2	Toyota / Lexus	348

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

5.23.3	Toyota Revenue	349
5.32	Vecna Technologies	350
5.33	Volkswagen	350
5.33.5	Volkswagen Revenue and Shipments	351
5.33.6	Volkswagen Brands	354
5.33.7	Porsche SE	354
5.34	Volvo	355
5.34.5	Volvo Revenue	356
5.35	Visteon	357
5.35.5	Visteon Revenue	358
5.36	WiTricity	360

## Robot Cars and Trucks List of Tables and Figures

Table ES-1	24
Robot Cars and Trucks Market Driving Forces	24
Table ES-2	25
Autonomous Vehicle Features Driving Adoption of Robotic Cars	25
Table ES-3	27
Leaders in Development of Robot Cars and Trucks	27
Figure ES-4	29
Robot Commercial Autonomous Car Market Shipments Forecasts Dollars, Worldwide, 2013-2019	29
Table 1-1	31
Wireless Car Charger Market Characteristics	31
Table 1-2	42
Principal Features Used To Compare Rechargeable Batteries	42
Table 2-1	51
Robot Cars and Trucks Market Driving Forces	51
Table 2-2	52
Autonomous Vehicle Features Driving Adoption of Robotic Cars	52
Table 2-3	54
Leaders in Development of Robot Cars and Trucks	54
Figure 2-4	56
General Dynamics TAC-C Robot	56
Figure 2-5	57
Next-Generation General Dynamics Robots	57
Figure 2-6	59
Google Driverless Car	59
Figure 2-7	62
Northrop Grumman Mini-ANDROS II	62
Figure 2-8	63
IBM MessageSight Ford	63
Table 2-9	64
Toyota Production LS 2013 Model Self-Driving Tools Technology	64

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

# WinterGreen Research, INC.

Figure 2-11	69
Robot Commercial Autonomous Car Market Shipments Forecasts Dollars, Worldwide, 2013-2019	69
Table 2-12	70
Robot Car Shipments and Installed Base Compared to Electrical Vehicle Shipments and Installed Base Dollars and Units, Worldwide, 2013-2019	70
Table 2-13	72
Automotive Industry Market Factors	72
Table 2-14	73
Automotive Industry Limits On The Ability To Reduce Costs	73
Table 2-15	74
Electrical Vehicle Installed Base and Robot Cars and TrucksShipments Dollars and Units, Worldwide, 2012-2019	74
Table 2-16	75
Electrical Vehicle Installed Base and Robot Cars and TrucksShipments Dollars and Units, Worldwide, 2012-2019	75
Figure 2-17	76
Electric Vehicle EV Market Forecasts, Units, Worldwide, 2013-2019	76
Table 2-18	77
Electrical Vehicle Shipments and Robot Cars and TrucksMarket Penetration Dollars and Units, Worldwide, 2012-2019	77
Table 2-19	79
Larger Military Ground Robot Market Forecasts Units and Dollars, Worldwide, 2013-2019	79
Table 2-20	83
Unmanned Ground Systems Roadmap	83
Figure 2-21	91
Military Ground Robot Regional Market Segments, Dollars, 2012	91
Table 2-22	92
Military Ground Robot Regional Market Segments, 2012	92
Table 2-23	93
Military Ground Robot Installed Base and Shipments Market Forecasts, Units, Worldwide, 2013-2019	93
Figure 3-1	94
Google Self Driving Car	94
Figure 3-2	98
IBM MessageSight Ford	98
Figure 3-3	100
Ford Self Driving Car	100
Figure 3-4	101
Ford Robotic Auto Control System	101
Figure 3-5	103
Ford Robotic Auto Control System	103
Figure 3-6	104
Nissan EPORO Robot Car	104
Figure 3-7	105
Nissen Pivo	105
Figure 3-8	106
Nissan Pivo With Built-in HD Cameras	106

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**



# WinterGreen Research, INC.

Figure 3-9	107
Nissan Pivo Overall Design	107
Figure 3-10	108
GM Cadillac Self Driving Car	108
Figure 3-11	109
GM EN-V Hands Free Driverless Auto	109
Figure 3-12	110
GM EN-V Hands Free Driverless Auto	110
Figure 3-13	111
2013 Red Sonic General Motors Auto Driving	111
Figure 3-14	112
Toyota Self Driving Car	112
Figure 3-15	114
Toyota Self Driving Car Wheel	114
Table 3-16	115
Toyota Autonomous Driving Tools	115
Table 3-17	116
Toyota production LS 2013 Model Self-Driving Tools Technology	116
Figure 3-18	117
Audi Connect	117
Figure 3-19	118
Mercedes-Benz Self Driving Car	118
Figure 3-20	120
Volkswagen Self Driving Car	120
Figure 3-21	121
Volkswagen TAP Autopilot	121
Table 3-22	122
Volkswagen TAP Automatic Driving Support Technology	122
Figure 3-23	123
Volvo Self Driving Car Functions	123
Figure 3-24	124
Volvo Self Driving Car Auto Parking	124
Figure 3-25	125
BMW Self Driving Car	125
Table 3-26	128
Subaru Adaptive Cruise Control Features	128
Figure 3-27	130
Honda Car Safety Adapter Systems	130
Table 3-28	133
Hyundai Genesis Smart Cruise Control	133
Figure 3-29	136
Land Rover Range Rover	136
Figure 3-30	138
Land Rover Range Rover	138
Table 3-31	140
Land Rover Terrain Response® Functions	140
Figure 3-32	141

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

# WinterGreen Research, INC.

Land Rover Range Rover	141
Table 3-33	142
Land Rover Enhanced Active Safety Technologies	142
Figure 3-34	143
Land Rover Range Rover	143
Figure 3-35	145
Lexus Adaptive Cruise Control	145
Figure 3-36	149
Porsche Adaptive Cruise Control Illustrated	149
Figure 3-37	149
Buick LaCrosse 2014	149
Table 3-38	151
GM Safety Technology	151
Figure 3-39	152
Chrysler Adaptive Cruise Control	152
Figure 3-40	154
Dodge Durango 2014	154
Figure 3-41	156
Kongsberg CORTEX	156
Figure 3-42	157
BAE Systems Remote Military Land Vehicles	157
Figure 3-43	159
Kairos Autonomi Pronto4 Retrofitting System for Existing Vehicles or Vessels	159
Figure 3-44	160
Kairos Pronto4™ Agnostic Autonomy System	



Table 3-45	161
Kairos Pronto4™ Agnostic Autonomy Sub-Systems	161
Table 3-46	162
Kairos ProntoMimic Software Suite Features	162
Figure 3-47	163
Lockheed Martin SMSS	163
Table 3-48	165
General Dynamics GDRS Functions Needed To Perform A Variety Of Military, Government And Civilian Missions	165
Table 3-49	166
General Dynamics Autonomous Systems Implementation Functions	166
Table 3-50	167

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

# WinterGreen Research, INC.

General Dynamics Military Robots Functions	167
Table 3-51	168
General Dynamics Military Robot Positioning	168
Table 3-52	169
General Dynamics Military Warfighter Support	169
Table 3-53	170
General Dynamics MDARS Features:	170
Figure 3-54	171
General Dynamics Tactical Autonomous Combat – Chassis (TAC - C)	171
Figure 3-55	172
General Dynamics Tactical Autonomous Combat TAC-C Capabilities	172
Figure 3-56	172
General Dynamics Tactical Autonomous Combat TAC-C Vehicle Specifications	172
Figure 4-1	174
Nissan Fish Behavior Rules Model for Robot Car	174
Table 4-2	175
Fish Behavior Rules	175
Table 4-3	179
Automakers With Adaptive Cruise Control (Mid-2013)	179
Figure 4-4	187
Hitachi Modular Robot Configuration	187
Table 4-5	189
Military Robot Key Product Technology Factors	189
Table 4-16 (Continued)	190
Military Robot Key Product Technology Factors	190
Table 4-17	195
Military Robot Technology Functions	195
Table 4-17 (Continued)	195
Military Robot Technology Functions	195
Table 4-6	199
Missions (UUV “Sub-Pillars”) In Priority Order	199
Figure 4-7	200
UUVMP Vision	200
Table 4-8	201
Alliant Features:	201
Table 4-8 (Continued)	202
Alliant Features:	202
Figure 4-9	206
iRobot / Evolution Robotics Technology Solutions	206
Figure 4-10	208
Military Robot Technology Enablers	208
Table 4-11	209
Military Robot Technology Characteristics	209
Figure 4-12	210
Military Ground Robot Ground Domain Technology Enablers	210
Table 4-13	211
US Army Military Robot Logistics Positioning	211

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

# WinterGreen Research, INC.

Figure 4-14	215
Robot Systems Associated with Force Application Description	215
Figure 4-15	216
Robotic Performance Characteristics	216
Table 4-16	218
Military Robotics Enabling Technology	218
TABLE 4-17	219
Military Robots Development Challenges	219
Table 4-18	220
Military Robot Integrated Circuit-Based Innovation Functions	220
Table 4-19	222
Military Robot Key Technology	222
Table 4-20	223
Robot Communications Key Technology	223
Table 4-21	224
Military Robot Key Navigation Technologies	224
Figure 5-1	226
Allen Vanguard Threat Intelligence	226
Table 5-2	227
Allen-Vanguard R&D Team Mandate:	227
Table 5-3	228
Allen-Vanguard Scientific And Engineering Topics Researched and Developed	228
Table 5-4	229
Allen-Vanguard R&D Fundamental Research	229
Table 5-5	230
Allen-Vanguard R&D Engineers And Scientists Comprehensive Research	230
Table 5-6	233
BAE Systems Standards	233
Figure 5-7	234
BAE Systems Revenue in Defense Market	234
Figure 5-8	237
Boston Dynamic LS3	237
Figure 5-9	238
Boston Dynamic CHEETAH	238
Figure 5-10	240
Boston Dynamic Atlas	240
Figure 5-11	242
Boston Dynamic BigDog	242
Figure 5-12	244
Boston Dynamics LittleDog -	244
Table 5-13	269
ECA Robotics Range Of Products	269
Table 5-14	270
Elbit Systems Activities:	270
Table 5-15	272
Elbit Systems Activities:	272
Table 5-16	276

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

# WinterGreen Research, INC.

Factors Impacting Ford Profitability Of Business	276
Table 5-17	280
G-NIUS Unmanned Ground Systems (UGS) Solutions	280
Table 5-18	285
Google Autonomous Vehicles Technology	285
Table 5-19	296
GM Market Positioning	296
Figure 5-20	310
Lockheed Martin Segment Positioning	310
Table 5-21	311
Lockheed Martin's operating units	311
Figure 5-22	313
Lockheed Martin Aeronautics Segment Positioning	313
Figure 5-23	314
Lockheed Martin Aeronautics Segment Portfolio	314
Figure 5-24	315
Lockheed Martin Aeronautics C130 Worldwide Airlift	315
Figure 5-25	316
Lockheed Martin Aeronautics Falcon Fighter	316
Figure 5-26	317
Lockheed Martin Electronic Systems Portfolio	317
Table 5-27	319
Mesa Robotics Technical Experience	319
Table 5-28	336
Thales Key Technology Domains	336
Figure 5-29	337
Thales Measurable Environmental Targets	337
Figure 5-30	341
Thales Group Ground Master 400	341
Table 5-31	342
Thales Group GROUND Master 400 Key Features:	342
Table 5-32	343
Thales Group Ground Smarter 1000 Key Features:	343
Figure 5-33	344
Thales Critical Decision Chain	344
Figure 5-34	346
Toyota Qi Wireless Charging	346
Table 5-35	348
Toyota / Lexus Advanced Active Safety Research Vehicle Features	348
Figure 5-36	352
Volkswagen Shipments in Comparison to World Car Shipments	352
Figure 5-37	354
Volkswagon Brands	354
Figure 5-38	361
WiTricity Technology	361

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

## **ABOUT THE COMPANY**

**WinterGreen Research**, research strategy relates to identifying market trends through reading and interviewing opinion leaders. By using analysis of published materials, interview material, private research, detailed research, social network materials, blogs, and electronic analytics, the market size, shares, and trends are identified. Analysis of the published materials and interviews permits WinterGreen Research senior analysts to learn a lot more about markets. Discovering, tracking, and thinking about market trends is a high priority at WinterGreen Research. As with all research, the value proposition for competitive analysis comes from intellectual input.

**WinterGreen Research**, founded in 1985, provides strategic market assessments in telecommunications, communications equipment, health care, Software, Internet, Energy Generation, Energy Storage, Renewable energy, and advanced computer technology. Industry reports focus on opportunities that expand existing markets or develop major new markets. The reports access new product and service positioning strategies, new and evolving technologies, and technological impact on products, services, and markets. Innovation that drives markets is explored. Market shares are provided. Leading market participants are profiled, and their marketing strategies, acquisitions, and strategic alliances are discussed. The principals of WinterGreen Research have been involved in analysis and forecasting of international business opportunities in telecommunications and advanced computer technology markets for over 30 years.

The studies provide primary analytical insight about the market participants. By publishing material relevant to the positioning of each company, readers can look at the basis for analysis. By providing descriptions of each major participant in the market, the reader is not dependent on analyst assumptions, the information backing the assumptions is provided, permitting readers to examine the basis for the conclusions.

WinterGreen Research is positioned to help customers facing challenges that define the modern enterprises. The increasingly global nature of science, technology and engineering is a reflection of the implementation of the globally integrated enterprise. Customers trust wintergreen research to work alongside them to ensure the success of the participation in a particular market segment.

WinterGreen Research supports various market segment programs; provides trusted technical services to the marketing departments. It carries out accurate market share and forecast analysis services for a range of commercial and government customers globally. These are all vital market research support solutions requiring trust and integrity.

### **ABOUT THE PRINCIPAL AUTHORS**

**Ellen T. Curtiss**, Technical Director, co-founder of WinterGreen Research, conducts strategic and market assessments in technology-based industries. Previously she was a member of the staff of Arthur D. Little, Inc., for 23 years, most recently as Vice President of Arthur D. Little Decision Resources, specializing in strategic planning and market development services. She is a graduate of Boston University and the Program for Management Development at Harvard Graduate School of Business Administration. She is the author of recent studies on worldwide telecommunications markets, the top ten internet equipment companies, the top ten contract manufacturing companies, and the Top Ten Telecommunications market analysis and forecasts.

**REPORT # SH25744089**

**362 PAGES**

**144 TABLES AND FIGURES**

**2013**

**\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING**

## WinterGreen Research, INC.

**Susan Eustis**, President, co-founder of WinterGreen Research is a senior analyst. She has done research in communications and computer markets and applications. She holds several patents in microcomputing and parallel processing. She has the original patents in electronic voting machines. She has new patent applications in format varying, multiprocessing, and electronic voting. She is the author of recent studies of the Solar RENEWABLE Energy, Wind Energy, Thin Film Batteries, Business Process Management marketing strategies, Internet equipment, biometrics, a study of Internet Equipment, Worldwide Telecommunications Equipment, Top Ten Telecommunications, Digital Loop Carrier, Web Hosting, Web Services, and Application Integration markets. Ms. Eustis is a graduate of Barnard College. . Ms. Eustis was named Top Woman CEO in 2012 by Who's Who Worldwide. She was named Top Woman Market Research Analyst the same year.

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING

# WinterGreen Research, INC.

## ORDER FORM

Return To: WinterGreen Research, Inc.

6 Raymond Street

Lexington, MA 02421 USA

Phone: (781) 863-5078 --- Fax: (781) 863-1235 (preferred) info@wintergreenresearch.com

PLEASE ENTER MY ORDER FOR:

## Robot Cars and Trucks: Market Shares, Strategies, and Forecasts, Worldwide, 2013-2019

**-ALL REPORTS ARE AVAILABLE IN EITHER PRINT OR PDF-**

\_\_\_\_\_ **PDF** \_\_\_\_\_ **PRINT**

\_\_\_ ENCLOSED IS MY CHECK FOR \$3,800 FOR SINGLE COPY, \$7,600 FOR WEB SITE POSTING

\_\_\_ PLEASE BILL MY COMPANY USING P.O. NUMBER \_\_\_\_\_

\_\_\_ PLEASE CHARGE MY MASTERCARD/VISA/AMERICAN EXPRESS—

CARD NUMBER \_\_\_\_\_ EXP. DATE \_\_\_\_\_

If charging to a credit card use the shopping card order form on the Internet, fax, or call.

NAME \_\_\_\_\_ TITLE \_\_\_\_\_

SIGNATURE \_\_\_\_\_

COMPANY \_\_\_\_\_ DIVISION \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE / ZIP \_\_\_\_\_

TELEPHONE \_\_\_\_\_

FAX \_\_\_\_\_

EMAIL \_\_\_\_\_

*PLEASE NOTE:* RESIDENTS OF MASSACHUSETTS AND CONNECTICUT MUST INCLUDE APPROPRIATE SALES TAX

SUBSCRIBERS OUTSIDE THE UNITED STATES MUST PROVIDE PREPAYMENT IN U.S. FUNDS

REPORT # SH25744089

362 PAGES

144 TABLES AND FIGURES

2013

\$3,800 SINGLE COPY -- \$7,600 WEB SITE POSTING