



DSIAC TECHNICAL INQUIRY (TI) RESPONSE REPORT

Lightweight Unmanned Ground Systems (UGS) Maneuvering in Difficult Terrain

Report Number:

DSIAC-2019-1064

Completed March 2019

DSIAC is a Department of Defense
Information Analysis Center

MAIN OFFICE

4695 Millennium Drive
Belcamp, MD 21017-1505
443-360-4600

REPORT PREPARED BY:

Georgia Tech Research Institute

Information contained in this report does not constitute endorsement by the U.S. Department of Defense or any nonfederal entity or technology sponsored by a nonfederal entity.

DSIAC is sponsored by the Defense Technical Information Center, with policy oversight provided by the Office of the Under Secretary of Defense for Research and Engineering. DSIAC is operated by the SURVICE Engineering Company.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE (DD-MM-YYYY) 01-03-2019		2. REPORT TYPE Technical Research Report		3. DATES COVERED (From - To)		
4. TITLE AND SUBTITLE Lightweight Unmanned Ground Systems (UGS) Maneuvering in Difficult Terrain				5a. CONTRACT NUMBER FA8075-14-D-0001		
				5b. GRANT NUMBER		
				5c. PROGRAM ELEMENT NUMBER		
6. AUTHOR(S) Georgia Tech Research Institute				5d. PROJECT NUMBER		
				5e. TASK NUMBER		
				5f. WORK UNIT NUMBER		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Defense Systems Information Analysis Center (DSIAC) SURVICE Engineering Company 4695 Millennium Drive Belcamp, MD 21017-1505				8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Defense Technical Information Center (DTIC) 8725 John J. Kingman Rd. Ft. Belvoir, VA 22060-6218				10. SPONSOR/MONITOR'S ACRONYM(S)		
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)		
12. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release: distribution unlimited.						
13. SUPPLEMENTARY NOTES Ground and Sea Platforms: Unmanned Platforms; Autonomous Systems						
14. ABSTRACT The Defense Systems Information Analysis Center (DSIAC) was asked to provide a list of unmanned ground vehicles (UGVs) that can maneuver in difficult terrain and enter buildings. The UGVs of interest were required to weigh less than 15 lb. The inquirer also specified that the UGVs must be able to carry a payload of sensors and other equipment and use a variety of locomotion methods. DSIAC staff investigated unclassified data using the Association for Unmanned Vehicle Systems International database and identified 63 applicable systems. Information on each system (including platforms names, locomotion methods, market categories, applications, primary organizations, countries, points of contact, and websites) was consolidated into data tables for further use.						
15. SUBJECT TERMS unmanned ground systems, sensors, terrain, unmanned ground vehicles						
16. SECURITY CLASSIFICATION OF: U			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON	
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U	UU	18	Ted Welsh, DSIAC Director	
					19b. TELEPHONE NUMBER (include area code) 443-360-4600	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39.18

ABOUT DTIC AND DSIAC

The Defense Technical Information Center (DTIC) collects, disseminates, and analyzes scientific and technical information to rapidly and reliably deliver knowledge that propels development of the next generation of Warfighter technologies. DTIC amplifies the U.S. Department of Defense's (DoD's) multibillion dollar annual investment in science and technology by collecting information and enhancing the digital search, analysis, and collaboration tools that make information widely available to decision makers, researchers, engineers, and scientists across the Department.

DTIC sponsors the DoD Information Analysis Center's (IAC's) program, which provides critical, flexible, and cutting-edge research and analysis to produce relevant and reusable scientific and technical information for acquisition program managers, DoD laboratories, Program Executive Offices, and Combatant Commands. The IACs are staffed by, or have access to, hundreds of scientists, engineers, and information specialists who provide research and analysis to customers with diverse, complex, and challenging requirements.

The Defense Systems Information Analysis Center (DSIAC) is a DoD IAC sponsored by DTIC to provide expertise in nine technical focus areas: weapons systems; survivability and vulnerability; reliability, maintainability, quality, supportability, and interoperability; advanced materials; military sensing; autonomous systems; energetics; directed energy; and non-lethal weapons. DSIAC is operated by SURVICE Engineering Company under contract FA8075-14-D-0001.

ABSTRACT

The Defense Systems Information Analysis Center (DSIAC) was asked to provide a list of unmanned ground vehicles (UGVs) that can maneuver in difficult terrain and enter buildings. The UGVs of interest were required to weigh less than 15 lb. The inquirer also specified that the UGVs must be able to carry a payload of sensors and other equipment and use a variety of locomotion methods. DSIAC staff investigated unclassified data using the Association for Unmanned Vehicle Systems International database and identified 63 applicable systems. Information on each system (including platforms names, locomotion methods, market categories, applications, primary organizations, countries, points of contact, and websites) was consolidated into data tables for further use.

Contents

ABOUT DTIC AND DSIAC.....	iii
ABSTRACT	iv
1.0 TI Request	1
1.1 INQUIRY	1
1.2 DESCRIPTION	1
2.0 TI Response	1
REFERENCES.....	9
APPENDIX A: Detailed List of Unmanned Ground Vehicles (UGVs)	Error!

Bookmark not defined.

1.0 TI Request

1.1 INQUIRY

What robots weighing less than 15 lb can be used for entering difficult terrain and buildings?

1.2 DESCRIPTION

The inquirer requested a list of potential robots used that can enter difficult terrain and buildings. The unmanned ground vehicles (UGVs) must weigh less than 15 lb, carry a payload of sensors and other equipment, and use a variety of locomotion methods, including biomimicry, walking, tracking, slithering, etc.

2.0 TI Response

Defense Systems Information Analysis Center (DSIAC) staff searched the Association for Unmanned Vehicle Systems International (AUVSI) database for platforms relevant to the inquirer's request. The results of the search are consolidated in Table 1, which provides a list of UGV platform names, method of locomotion, market category, applications, primary production organization, and country of origin. UGVs were included in Table 1 if they had a total weight under 15 lb. and were intended for mobility on rough terrain and entering buildings or other structures.

Table 1: UGVs Meeting the Criteria of the TI

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
110 FirstLook [1]	Tracked	Civil; military	Chemical, biological, radiological, and nuclear (CBRN); disaster response; exploration; explosive ordnance disposal; inspection; intelligence, surveillance, and reconnaissance (ISR); observation, patrol, security; search and rescue (SAR); target acquisition.	Endeavor Robotics	United States
ACM-R4H [2]	Wheeled	Civil; commercial; military	Exploration; inspection; ISR; patrol, security; pipeline services.	HiBot Corp.	Japan
ALTINAY UGV [3]	Tracked	Civil; commercial; military	Explosive ordnance disposal; firefighting; inspection; ISR; logistics; patrol, security.	ALTINAY Aerospace & Advanced Technologies	Turkey
ANATROLLER ARI-10 [4]	Wheeled	Commercial	Cleaning; inspection; maintenance.	Robotics Design, Inc.	Canada
ANATROLLER ARI-50 [5]	Tracked	Commercial	Cleaning; inspection; maintenance; pipeline services.	Robotics Design, Inc.	Canada
ARTHRON POD 050 A [6]	Tracked	Civil; commercial	Imaging; inspection; pipeline services.	M-Tecks ROBOTICS	France
ARTHRON POD 125 A [6]	Wheeled	Civil; military	Exploration; explosive ordnance disposal; imaging; inspection; ISR; patrol, security; SAR; target acquisition.	M-Tecks ROBOTICS	France
Aspire-CAM [7]	Wheeled	Consumer; commercial	Hobby; imaging.	Thunder Tiger Corporation	Taiwan
BILL-ANT [8]	Legged	Academic	Education; prototype; research.	Case Western Reserve University	United States

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
Delta Extreme [9]	Tracked	Civil; commercial; military	CBRN; disaster response; exploration; inspection; ISR; patrol, security; pipeline services; SAR; target acquisition.	Crystal Cam Imaging, Inc.	Canada
Delta Micro [9]	Tracked	Civil; commercial; military	CBRN; disaster response; exploration; inspection; ISR; patrol, security; pipeline services; SAR; target acquisition.	Crystal Cam Imaging, Inc.	Canada
DraganScout [10]	Wheeled	Civil; military	Disaster response; exploration; ISR; observation; patrol, security; SAR; target acquisition.	Draganfly Innovations, Inc.	Canada
Dragon Runner 10 [11]	Tracked	Civil; military	Disaster response; exploration; explosive ordnance disposal; inspection; ISR; patrol, security; SAR; target acquisition.	QinetiQ North America	United States
Enter, Survey, and Perceive (ESP) Toss Bot [12]	Wheeled	Civil; military	Exploration; inspection; ISR; patrol, security; SAR; target acquisition.	SuperDroid Robots, Inc.	United States
EyeDrive [13]	Wheeled	Civil; military	Exploration; explosive ordnance disposal; inspection; ISR; patrol, security; SAR.	Mistral Security, Inc.	United States
Ghost Minitaur [14]	Legged	Civil; commercial; military; academic	Disaster response; education; exploration; inspection; ISR; patrol, security; research; SAR; training.	Ghost Robotics	United States
Highly Adaptive Robotic Vehicle (HARV) [15]	Rolling	Civil; commercial; military	Exploration; inspection; ISR; patrol, security; prototype.	GuardBot, Inc.	United States
Inbot [16]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; pipeline services; SAR; target acquisition.	ECA	France

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
Inspector Robot III [17]	Wheeled	Commercial	Cleaning; inspection; maintenance.	Indoor Environmental Solutions, Inc.	United States
Iris [18]	Tracked	Civil; commercial	Inspection; prototype; research.	Future Robotics Technology Center	Japan
Individual Robotic Intelligence System (IRIS) [19]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	Roboteam, INC.	United States
Koala [20]	Wheeled	Commercial; academic	Research	AAI Canada, Inc.	Canada
Mini-CALIBER [21]	Wheeled	Civil; military	Exploration; explosive ordnance disposal; inspection; ISR; patrol, security; target acquisition.	ICOR Technology	Canada
MINIBOT [22]	Wheeled	Civil; commercial	Cable services; CBRN; disaster response; imaging; inspection; ISR; patrol, security.	Inspectorbots	United States
MINI-UGV [23]	Tracked	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	King Abdullah II Design and Development Bureau	Jordan
MLT-F Jack Russell [24]	Tracked	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	SuperDroid Robots, Inc.	United States
MLT-PT Jack Russell [24]	Tracked	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	SuperDroid Robots, Inc.	United States
MQ10 [25]	Tracked	Civil; commercial; military; academic	Disaster response; exploration; ISR; pipeline services; research; SAR.	Mechatroniq Systems, Inc.	Canada

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
MQ50 [25]	Wheeled	Civil; commercial; military	Environmental research or monitoring; inspection; ISR; patrol, security.	Mechatroniq Systems, Inc.	Canada
MQ75 [25]	Wheeled	Civil; commercial; military; academic	disaster response; environmental research or monitoring; exploration; inspection; ISR; patrol, security; research; SAR; target acquisition.	Mechatroniq Systems, Inc.	Canada
NanoMag [26]	Tracked	Civil; commercial	Inspection; pipeline services.	Inuktun	Canada
NERVA-LG [27]	Wheeled	Civil; military	CBRN; exploration; explosive ordnance disposal; inspection; ISR; patrol, security; SAR; target acquisition.	Nexter Robotics	France
NERVA-S [27]	Wheeled	Civil; military	Exploration; inspection; ISR; patrol, security; SAR; target acquisition.	Nexter Robotics	France
OCT-1C [28]	Legged	Academic	Education; prototype; research.	AAI Canada, Inc.	Canada
R1 [29]	Wheeled	Commercial; academic	Education; research.	Aion Robotics	United States
R6 [29]	Wheeled	Civil; commercial; academic	Disaster response; education; imaging; inspection; patrol, security; precision agriculture; research; SAR; survey, mapping.	Aion Robotics	United States
Recon Scout Infrared (IR) [30]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	ReconRobotics, Inc.	United States
Recon Scout Rescue [31]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	ReconRobotics, Inc.	United States
Recon Scout Throwbot LE [32]	Wheeled	Civil	Disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition	ReconRobotics, Inc.	United States

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
Recon Scout Throwbot XT [33]	Wheeled	Civil; military	Communications; disaster response; exploration; inspection; ISR; patrol, security; SAR; target acquisition.	ReconRobotics, Inc.	United States
Recon Scout Under Vehicle Inspection (UVI) Robot [34]	Wheeled	Civil; military	Inspection	ReconRobotics, Inc.	United States
RiSE [35]	Legged	Academic	Prototype; research.	Boston Dynamics, Inc.	United States
ROMP [36]	Wheeled	Civil; commercial; military; academic	Attack, weapons delivery; CBRN; disaster response; environmental research or monitoring; exploration; inspection; ISR; patrol, security; research; SAR; target acquisition.	Inspectorbots	United States
Rover 5 Robot Platform [37]	Tracked	Consumer; commercial; academic	Education; hobby; research.	Australian Robotics Pty Ltd.	Australia
RP5 Tank-Tread Robot Platform [37]	Tracked	Consumer; commercial; academic	Education; hobby; research.	Australian Robotics Pty Ltd.	Australia
SandFlea [35]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; prototype; research; SAR; target acquisition.	Boston Dynamics, Inc.	United States
SCORP [38]	Tracked	Civil; military	Disaster response; exploration; ISR; pipeline services; research; SAR.	Novatiq	Switzerland

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
SCORPIO [39]	Wheeled	Civil; commercial; military; academic	Disaster response; exploration; inspection; ISR; patrol, security; research; SAR; target acquisition.	TECDRON	France
Scorpio [40]	Tracked	Civil; military	Exploration; explosive ordnance disposal; ISR; target acquisition.	Kerametal, s.r.o	Slovakia
SECT II [41]	Wheeled	Commercial; academic	Education; exploration; research.	AAI Canada, Inc.	Canada
Shrimp III [42]	Wheeled	Civil; commercial	Disaster response; exploration; firefighting; prototype; research; SAR.	BlueBotics	Switzerland
SIRE [43]	Wheeled	Civil; military	Exploration; explosive ordnance disposal; inspection; ISR; logistics; patrol, security; SAR; target acquisition.	Tactical Electronics - Aviation	United States
Spider Mite [44]	Wheeled	Civil; commercial	Cable services; CBRN; disaster response; exploration; inspection; ISR; patrol, security.	Inspectorbots	United States
Sprawl Tuned Autonomous Robot (STAR) [45]	Wheeled	Academic	Prototype; research.	University of California, Berkley – Electrical Engineering and Computer Science (EECS) Biomimetic Millisystems Lab	United States

Platform Name	Locomotion	Market Category	Application	Primary Organization	Country
Stingray Novel Unmanned Ground Vehicle (NUGV) [46]	Tracked	Civil; military	Exploration; inspection; ISR; patrol, security; SAR; target acquisition.	Macro USA	United States
Tactical Throwable Robot (TRM) [47]	Wheeled	Civil; military	Exploration; explosive ordnance disposal; inspection; ISR; patrol, security; SAR; target acquisition	Przemyslowy Instytut Automatyki I Pomiarów	Poland
TAS [25]	Wheeled	Civil; academic	Disaster response; exploration; inspection; ISR; patrol, security; research.	Mechatroniq Systems, Inc.	Canada
Testudo [48]	Wheeled	Commercial; academic	Exploration; explosive ordnance disposal; inspection; ISR; patrol, security; research; target acquisition.	Mindsheet Ltd.	United Kingdom
TOUGHBOT [49]	Wheeled	Civil; military	Exploration; inspection; ISR; patrol, security; SAR; target acquisition.	Omnitech Robotics, Inc.	United States
Trackbot [50]	Tracked	Civil; commercial; military; academic	Cable services; chemical, CBRN; disaster response; education; exploration; inspection; ISR; patrol, security; research.	Inspectorbots	United States
TRP3 – NEC [51]	Wheeled	Civil; military	Disaster response; exploration; inspection; ISR; patrol, security; target acquisition.	Oto Melara SPA	Italy
UM4 [52]	Wheeled	Civil; commercial; military	Exploration; inspection; ISR; patrol, security; target acquisition.	SuperDroid Robots, Inc.	United States
WallRover A [53]	Tracked	Civil; commercial	Inspection; survey, mapping.	WALLROVER Ltd.	United Kingdom

REFERENCES

- [1] Australian Robotics Pty Ltd. <http://australianrobotics.com.au/>, accessed 13 March 2019.
- [2] AAI Canada, Inc. "OCT-1C: A Dependable Biorobot/animat Platform for a Wide Range of Scientific Researches and Experiments." http://www.aai.ca/robots/oct_1c.html, accessed 13 March 2019.
- [3] AAI Canada, Inc. "SECT II: Mobile Platform for Rough Terrain." <http://www.aai.ca/robots/sect2.html>, accessed March 2019.
- [4] AAI Canada, Inc. "Koala: High Precision Mobile Platform." <http://www.aai.ca/robots/koala.html>, accessed 13 March 2019.
- [5] Crystal Cam Imaging Inc. "Products." <http://crystal-cam.com/remote-visual-inspection-products/robotic-crawlers/>, accessed 13 March 2019.
- [6] Draganfly Innovations Inc. <http://www.draganfly.com/>, accessed 13 March 2019.
- [7] ICOR Technology. "Advancing Security with Extreme Precision." <http://www.icortechnology.com/>, accessed 13 March 2019.
- [8] Inuktun Services Ltd. "NanoMag™." <http://inuktun.com/en/products/onsite-standard-products/nanomag-miniature-magnetic-crawler/>, accessed 13 March 2019.
- [9] Mechatroniq Systems, Inc. <http://www.mechatroniq.com/default.aspx>, accessed 13 March 2019.
- [10] Robotics Design. "ANATROLLER™ ARI-10." <http://www.roboticsdesign.qc.ca/mobile-robots/hvac-cleaning-and-inspection/ari10/>, accessed 13 March 2019.
- [11] Robotics Design. "ANATROLLER™ ARI-50." <http://www.roboticsdesign.qc.ca/mobile-robots/hvac-cleaning-and-inspection/ari50/>, accessed 13 March 2019.
- [12] ECA. "Inbot." http://www.eca-robotics.com/ftp/ecatalogue/24/INBOT_GB.pdf, accessed 13 March 2019.
- [13] M-Tecks ROBOTICS. <http://www.m-tecksrobotics.com/>, accessed 13 March 2019.
- [14] Nexter Robotics. "Présentation." <http://www.nexter-group.fr/en/robotics-presentation>, accessed 13 March 2019.

- [15] TECDRON. “SCORPIO.” <http://www.tecdron.fr/en/robots-models/scorpio-2/>, accessed 13 March 2019.
- [16] Oto Melara SPA. “TRP3-NEC.” <http://www.army-guide.com/eng/product5744.html>, accessed 13 March 2019.
- [17] Future Robotics Technology Center. “Iris.” <http://www.furo.org/en/works/iris.html>, accessed 13 March 2019.
- [18] HiBot. <http://www.hibot.co.jp/>, accessed 13 March 2019.
- [19] King Abdullah II Design and Development Bureau. <http://kaddb.mil.jo/KADDBs-PORTFOLIO/SMART-SYSTEMS>, accessed 13 March 2019.
- [20] Przemyslowy Instytut Automatyki I Pomiarów. “TRM®.” <https://www.antiterrorism.eu/portfolio-posts/piap-trm/>, accessed 13 March 2019.
- [21] Kerametal, s.r.o. <http://www.kerametal.sk/en/company/>, accessed 13 March 2019.
- [22] BlueBotics. “Custom Solutions.” <http://www.bluebotics.com/custom-solutions/>, accessed 13 March 2019.
- [23] Novatig. <https://novatig.com/>, accessed 13 March 2019.
- [24] Thunder Tiger. <http://thundertiger.com/>, accessed 13 March 2019.
- [25] ALTINAY. “Unmanned Aerial Vehicle (UGV).” <http://www.altinay-advanced.com/solutions/unmanned-systems/unmanned-ground-vehicle/>, accessed 13 March 2019.
- [26] Mindsheet Ltd. <http://www.mindsheet.com>, accessed 13 March 2019.
- [27] WALLROVER Ltd. <http://www.wallrove0r.com/>, accessed 13 March 2019.
- [28] Aion Robotics. “R1 UGV.” <http://www.aionrobotics.com/r1>, accessed 13 March 2019.
- [29] Boston Dynamics. “Robots.” <https://www.bostondynamics.com/robots>, accessed 13 March 2019.
- [30] Case Western Reserve University. “BILL-ANT.” Biologically Inspired Robotics, [http:// biorobots.cwru.edu/projects/billant/](http://biorobots.cwru.edu/projects/billant/), accessed 13 March 2019.

- [31] Endeavor Robotics. "FirstLook®." <http://endeavorrobotics.com/products#110-firstlook>, accessed 13 March 2019.
- [32] Ghost Robotics Corp. "Ghost Q-UGVs are Superior to Wheels and Tracks on Unstructured Terrain." <https://www.ghostrobotics.io/>, accessed 13 March 2019.
- [33] Guardbot, Inc. <http://guardbot.org/>, accessed 13 March 2019.
- [34] Indoor Environmental Solutions, Inc. "Robotic Equipment." <http://www.cleanducts.com/re.asp>, accessed 13 March 2019.
- [35] Rogers, C. "The MINIBOT." Inspectorbots, <http://www.inspectorbots.com/MINIBOT.html>, accessed 13 March 2019.
- [36] Inspectorbots. "ROMP." <http://www.inspectorbots.com/ROMP.html>, accessed 13 March 2019.
- [37] Rogers, C. "The Spider Mite." Inspectorbots, http://www.inspectorbots.com/Spider_Mite_.html, accessed 13 March 2019.
- [38] Rogers, C. "The Trackbot." Inspectorbots, <https://www.inspectorbots.com/Trackbot.html>, accessed 13 March 2019.
- [39] Macro USA. <http://www.macrousa.com/>, accessed 13 March 2019.
- [40] Mistral Security, Inc. "EyeDrive™." <http://www.mistralsecurityinc.com/Our-Products/Tactical-Equipment/EyeDrive>, accessed 13 March 2019.
- [41] Omnitech Robotics, Inc. "TOUGHBOT." <http://omnitech.com/TOUGHBOT.html>, accessed 13 March 2019.
- [42] QinetiQ North America. "Dragon Runner®." <https://qinetiq-na.com/products/unmanned-systems/dragon-runner/>, accessed 13 March 2019.
- [43] ReconRobotics, Inc. "Recon Scout® IR." http://www.reconrobotics.com/products/scout_IR.cfm, accessed 13 March 2019.
- [44] ReconRobotics, Inc. "Recon Scout® Rescue." http://www.reconrobotics.com/products/recon_scout_rescue.cfm, accessed 13 March 2019.
- [45] ReconRobotics, Inc. "Recon Scout® Throwbot LE." http://www.reconrobotics.com/products/recon-scout_throwbot_LE.cfm, accessed 13 March 2019.

[46] ReconRobotics, Inc. "Recon Scout® Throwbot XT." http://www.reconrobotics.com/products/Throwbot_XT_audio.cfm, accessed 13 March 2019.

[47] ReconRobotics, Inc. "Recon Scout® UVI Robot." http://www.reconrobotics.com/products/under_vehicle_inspection.cfm, accessed 13 March 2019.

[48] Roboteam. "IRIS® - Your Eyes and Ears on the Ground – and Under It." <http://www.robo-team.com/products/iris/>, accessed 13 March 2019.

[49] SuperDroid Robots, Inc. "ESP 'Toss Bot' Surveillance & Inspection Robot." (Enter, Survey, and Perceive) ESP Data Sheet, http://www.superdroidrobots.com/product_info/SDR_ESP.pdf, 6 February 2009.

[50] SuperDroid Robots, Inc. "MLT "Jack Russell" - Compact Surveillance Robot." <http://www.sdr-tactical.com/MLT-Jack-Russell/>, accessed 13 March 2019.

[51] SuperDroid Robotics. "DEMO Prebuilt UM4 Compact Tactical Robot – SOLD." <http://www.superdroidrobots.com/shop/item.aspx/demo-prebuilt-um4-compact-tactical-robot-sold/1377/>, accessed 13 March 2019.

[52] Tactical Electronics. "SIRE." <http://www.tacticalectronics.com/product/sire-multi-functional-ied-robot/>, accessed 13 March 2019.

[53] Electrical Engineering and Computer Science (EECS) Biomimetic Millisystems Lab, University of California, Berkley. <http://robotics.eecs.berkeley.edu/~ronf/Biomimetics.html>, accessed 13 March 2019.