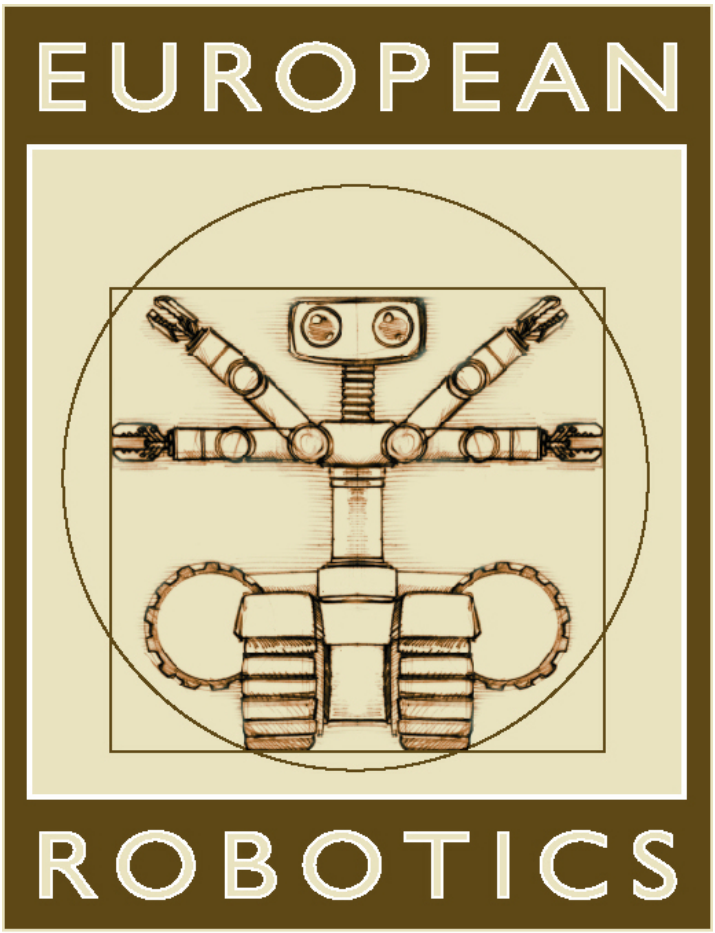
ELROB 2012

Catalouge



Participants

and

Exhibitors

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M-ELROB 2012

Training Ground of The Swiss Armed Forces

Thun, Switzerland

Welcome to ELROB 2012 in Thun. This year's event is the seventh edition of the European Land Robotics Trials. The trials have established themselves as Europe's leading outdoor robotics event.

After three exceedingly successful years in Hammelburg (Germany) this fourth presentation of the military version of ELROB is proudly hosted by armasuisse and sponsored by RUAG Defence. Under the roof of the R&D DACH initiative the event is situated in Switzerland, showing once more the successful co-operation between these three countries.

The purpose of the European Land Robotics Trials is to provide a comparative evaluation of outdoor robotic systems across applications such as basic mobility, scouting, EOD, convoying, etc. The trials will provide important information to potential users in terms of the maturity of current technologies. Through a baseline comparison of systems, it is also a prominent opportunity for vendors to understand current limitations and needs of end-users. ELROB furthermore provides an important venue for academics to understand challenges of technology transfer from research to field applications and basic research problems that remain unsolved.

The military ELROB addresses the fact that it is generally difficult for companies to get access to user feedback about their systems from actual end-users in the theatre. The event offers a unique insight into possible use cases. ELROB is thus an important event for all participants including end-users, providers, research institutes, and universities.

To promote new and future-oriented innovations, European Robotics, the scientific organisers of the event, will award up to four special Innovation Prizes. The purpose of the prizes is to recognize new ways of solving the challenges at hand as well as approaches with very strong potential.

We are convinced that this ELROB will again provide important insight into state of the art for military use of ground robotics and be a valuable resource in further dissemination of UGV technology.

We wish all ELROB visitors and participants a pleasant and successful stay in Thun.

Frank E. Schneider

Dep. Head of Unmanned Systems
Fraunhofer FKIE
frank.schneider@fkie.fraunhofer.de

Dr. Thomas Nussbaumer

UGV research program leader
armasuisse S+T / RUAG Defence
thomas.nussbaumer@ruag.com

Schedule

Opening Ceremony M-ELROB

Monday September 24, Training Ground of The Swiss Armed Forces In Thun

ca 12:30 h access to the Training Ground

13:30 h begin opening ceremony with speeches of

- Korpskommandant Dominique Andrey, commander of the Swiss Land Forces
- Mr Peter Hintermann, director of armasuisse S+T
- Prof. Henrik I. Christensen, Chief Judge M-ELROB

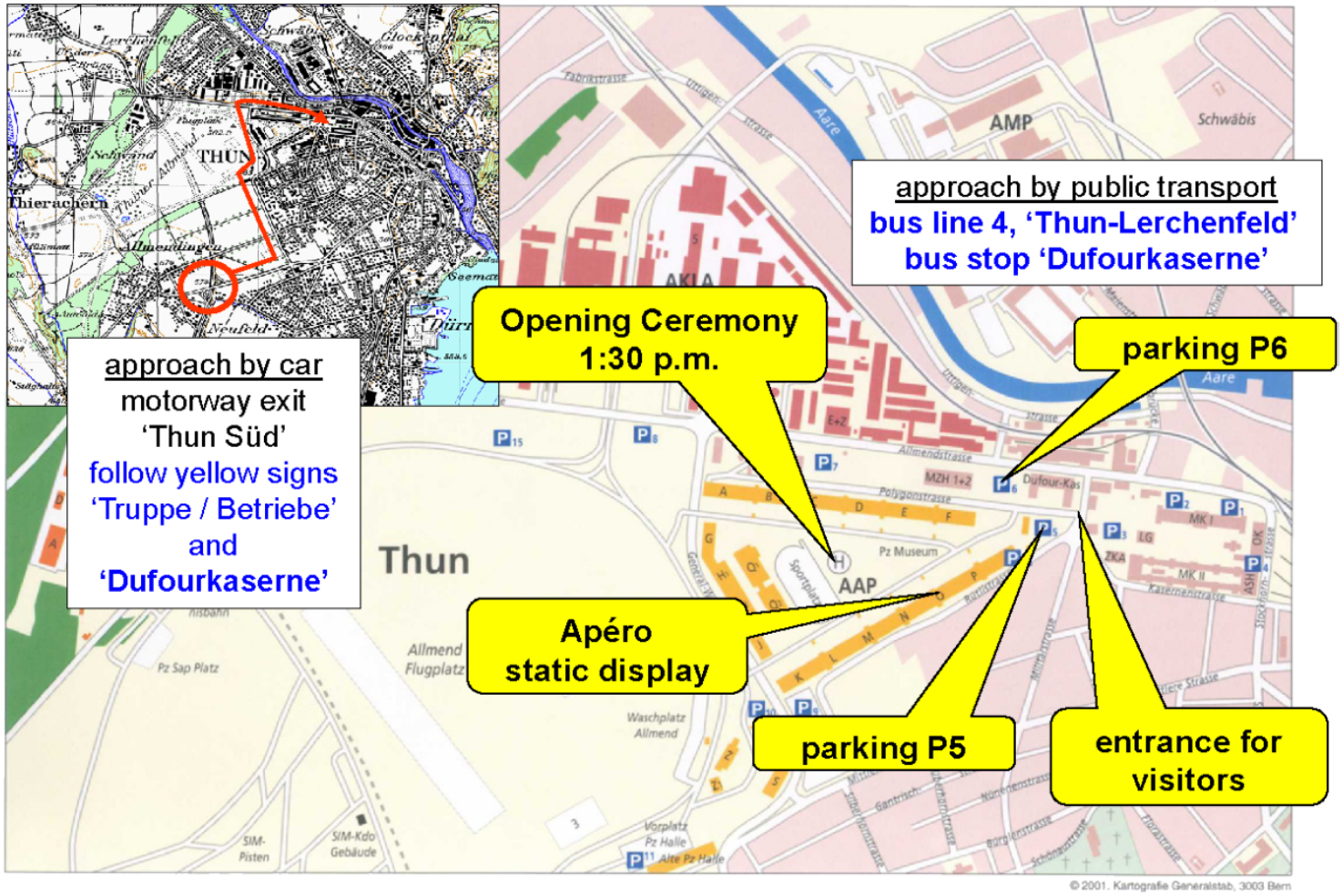
afterwards dynamic display of all trial and exhibition vehicles with their teams, moderated by Mr Sascha Ruefer

ca 16 h apéro and exhibition

ca 19 h end of event

Monday, 24.9.	Tuesday, 25.9.	Wednesday, 26.9.	Thursday, 27.9.
	Exhibition + Media day		
Official opening (13:00, **Please be on time**)	**Movements (09:00-11:30)**	**ISR Approach (09:00-16:30)**	**Mule (09:00-14:30)**
Team introduction/ system demonstration			
Exhibition	**ISR Recon (11:30-18:30)**		
Welcome reception			Farewell event
EOR/EOD/IEDD/CIED (starts at 09:00-12:30 & 16:00-18:00)		**ISR night (ca. 20:00-??:??)**	
	Team BBQ		Departure of teams

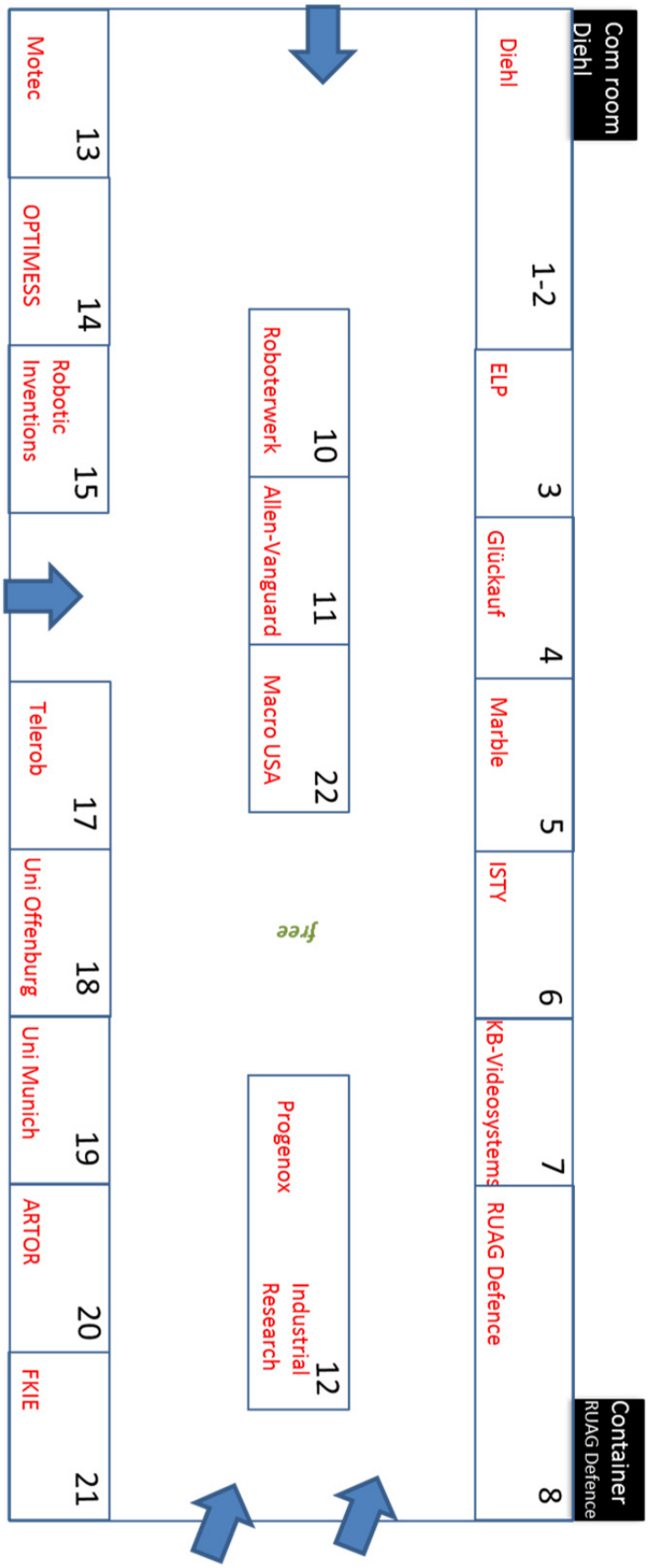
M-ELROB 2012, Swiss Army Training Ground, Thun
Monday 24. September, entrance open from 12:30 p. m.



Schweizer Armee
Kommando Waffenplatz Thun

Swiss Army training ground Thun

Static Display Plan



Chief Judge Team

1. Prof. Dr. Henrik I. Christensen, KUKA Chair of Robotics at the College of Computing, Director of the Center for Robotics and Intelligent Machines

2. Prof. Dr. Juha Röning, Head of Dept of Electrical and Information Engineering, University of Oulu

3. Prof. Dr. Alan FT Winfield, Associate Dean (Research) of the Faculty of Environment and Technology, University of the West of England, Bristol, UK

4. Kenneth A. Pink MBE, C.Eng C.MarEng M.I.MechE M.I.MarEST A. I,ExpE Snr Project Engineer and Technical lead for QinetiQ's Project GHOST.

5. Frank E. Schneider, FKIE, Head of EuropeanRobotics, Chair of NATO IST-107-RTG-052 "Standards Promoting Interoperability for Coalition UGVs"

Scenario Selections

	Team	ISR-App	ISR-Rec	EOD	Move	Mule	Static Display
1	Allen Vanguard			x			x
2	ARTOR (ETH Zürich, armasuisse, RUAG Defence)	x	x		x	x	x
3	ELP	x	x	x			x
4	FKIE	x	x			x	x
5	ISTY (University of Versailles)	x	x			x	x
6	MacroUSA	x	x	x			x
7	Marble (LAAS and ENAC)	x	x			x	x
8	Offenburg University of Applied Sciences	x	x	x			x
9	Red Eyes (The Kovrov State Technological Academy)					x	
10	Robotics Inventions	x	x		x	x	x
11	Telerob Gesellschaft für Fernhantierungstechnik mbH	x	x	x			x
12	UniBw Munchen	x			x	x	x
13	Wissenschaftlichen Forschungsdienst Federal Police Schweiz			x			
14	Zentrum für Kampfmittelbeseitigung der Bundeswehr Einsatzbereich B			x			
	Number of participants	10	9	7	3	7	11

1 Team Information ARTOR

Picture of vehicle:

Name of vehicle: ARTOR (Autonomous Rough Terrain Outdoor Robot)

Picture of team leader:

Name of team leader:	Philipp Krüsi
Team Name:	ARTOR
Team E-mail:	philipp.kruesi@mavt.ethz.ch
Website:	artor.ethz.ch
Location:	Switzerland
Institution/Company:	ETH Zürich, Autonomous Systems Lab Institute of Robotics and Intelligent Systems
Address:	Tannenstrasse 3, CLA E18 8092 Zürich
Telephone:	+41 44 632 06 98
Fax:	+41 44 632 11 81

Team Description:	Team ARTOR is a collaboration between the Autonomous Systems Lab (ASL) at ETH Zürich, RUAG Defence and armasuisse W+T. The team is composed of PhD and Master students at ASL and technical staff at RUAG Defence, under the leadership of Philipp Krüsi (PhD student, ETH/ASL) and Dr. Thomas Nussbaumer (Head of the armasuisse research program UGV, RUAG Defence). Our robot ARTOR (Autonomous Rough Terrain Outdoor Robot) is a 6-wheeled, skid-steered electric vehicle. An array of onboard sensors is used for monitoring the robot's state and gathering information about the environment for online mapping, localization and obstacle avoidance. The equipment includes a rotating 3D laser scanner, two 2D laser scanners, a stereo camera, a GPS receiver and an inertial measurement unit. Furthermore, a pan-tilt-zoom unit containing both a visual and a thermal camera is installed. All data processing for autonomous navigation, including mapping, localization, path planning, obstacle avoidance and motion control, is performed on the onboard computer, using the robot operating system ROS.
Sponsors:	-
Selection of scenario:	1. Reconnaissance and surveillance - ISR 2. Transport – Movements 3. Transport – Mule

1.1 Vehicle Specification Sheet Team ARTOR

Pictures of the vehicle:

left side

right side

rear front

rear front

Top

Name of vehicle:	ARTOR

1.1.1 Basic data about vehicle

Height:	125cm (Total height from ground to top, including antennas etc.)
Height:	125cm (Total height from ground to top of the vehicle)
Width:	75cm
Length:	140cm
Weight:	250kg
Ground clearance:	14cm
Average noise level:	60 dB(A) (approx.)
Climbing performance:	30 degree
Wheel or track driven:	wheels
Propulsion:	batteries
Endurance:	2hrs
Max. speed:	15Km/h
Payload:	50Kg

1.1.2 Communication equipment

Type:	WLAN 802.11b/g/n
Frequency:	2400 MHz
Possible frequency range:	from 2400 to 2500
Power:	100 mWatts
Modulation:	OFDM
Number of channels:	16

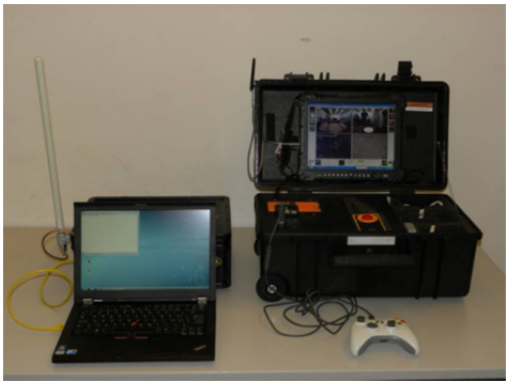
1.1.3 Sensors equipment

Laser:	1 x Velodyne HDL-32E 2 x Sick LMS 151
Vision:	1 x Point Grey Bumblebee2 (stereo, front) 1 x AVT Stingray (mono, back) 2 x color camera (1 front, 1 back) 1 x pan-tilt-zoom unit with thermal and visual camera
GPS:	Trimble Pathfinder ProXH
Inertial measurement unit:	Xsens MTi

1.1.4 Computing equipment on vehicle

Number of computers:	1
Number of CPUs:	4
Type of CPU:	Intel Core i7 1.7 GHz
Operating system(s):	Linux

1.1.5 Basic data about control station

Pictures of the control station:	 
Number of operators (mandatory/optional):	1/2
Number of computers:	2
Number of CPUs:	4
Type of CPU:	Intel Core i7 1.7 GHz
Operating system:	Linux
Space needed for control station:	100x200x100cm LWH
Weight of control station:	10kg
Power source needed:	230Volts with 500Watts

2 Team Information FKIE

Picture of vehicle:

Name of vehicle: Suworow

Picture of team leader:

Name of team leader:	Dirk Schulz
Team Name:	Team FKIE
Team E-mail:	dirk.schulz@fkie.frunhofer.de
Website:	www.fkie.fraunhofer.de
Location:	Germany
Institution/Company:	Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE
Address:	Neuenahrer Str. 20. 53343 Wachtberg
Telephone:	+49 228 9435 483
Fax:	+49 228 9435 210

Team Description:

Company Description:

The FKIE employs currently 300 staff members, who perform studies in computer science and ergonomics with application to diverse research area of command & control, communications, intelligence, surveillance, and reconnaissance (C3ISR).

A distinctive aspect of the FKIE methodology is the fact that we are as accomplished in technology as we are in the so called “human factor”. As experts in ergonomics we know how to equip technologies with user interfaces that are easy to operate and control. Also unique to us is the fact that we handle the entire data processing chain from acquisition to display allowing us to work in highly specialized units or interdisciplinary teams according to the project’s requirements.

- Analysis, modelling and evaluation of military data formats and processes
- Distributed data processing in heterogeneous systems (interoperability)
- Information and knowledge management
- Communication in heterogeneous networks
- Analysis and evaluation of sensor data sets
- Protection of data networks against interference or cyber attacks
- Ergonomic user interfaces for intelligent support of users.

The research group Unmanned Systems of the Fraunhofer-Institut for Communication, Information Processing and Ergonomics (FKIE) is actively researching in the area of unmanned systems for more than 20 years. Our main expertise is the development and evaluation of complex human-robot systems. The main focus is on the RSTA and CBRNE-reconnaissance missions using heterogeneous multi-robot systems. Working with such multi-robot systems is a competitive task for the operator. Even a single robot utilizes several different sensors and provides a high degree of mobility, which all need to be controlled by the operator. The research group Unmanned Systems approaches this challenge through intelligent assistance functions. The operator is supported by these assistance functionalities on all levels, ranging from navigating a single robot to complex planning problems of multi-robot systems. Assisting the operator is achieved by two key components. First, we enhance the autonomous capabilities of each single robot, and second, we reduce the burden on the operator through the assistance

functions. Navigation algorithms like obstacle avoidance in dynamic environments as well as methods to improve the presentation of available information are both examples of such functions. Our key skill is the development of innovative tools for human-robot interaction and cooperation. For this purpose new developments are constantly integrated in experimental systems and evaluated in co-operation with security authorities and organizations as well as the German army.

The Unmanned Systems department:

The Research Group Unmanned Systems as part of the FKIE develops innovative techniques for the efficient guidance of human-multi robot systems within military applications.

Remote-controlled unmanned mobile systems have high demands on the operator's concentration and cognitive abilities, especially if the control is to be maintained over long time periods. In order to increase the efficiency and the available deployment options, the research group develops assistance functions which enable the operator to guide the mobile systems on a high level of abstraction, while the robots execute the required low-level commands autonomously. Additionally, the research group serves as consultant and evaluator for the German army.

The booth presents an overview of the current activities of the FKIE regarding Unmanned Systems, in particular

- The experimental CBRNE Reconnaissance Platform
- NEC techniques for multi robot systems
- Mobile 3D world model generation
- Autonomous outdoor navigation
- European Land-Robot Trials (ELROB)

Sponsors: -

Selection of scenario: 1. Reconnaissance and surveillance - ISR

2. Transport – Movements

3. Transport – Mule

2.1 Vehicle Specification Sheet Team FKIE

Pictures of the vehicle:

front right

rear left

Name of vehicle: Suworow

2.1.1 Basic data about vehicle

Height:	132cm (Total height from ground to top, including antennas etc.)
Height:	132cm (Total height from ground to top of the vehicle)
Width:	74cm
Length:	162cm
Weight:	360kg
Ground clearance:	10cm
Average noise level:	60 dB(A) (approx.)
Climbing performance:	30 degree
Wheel or track driven:	track
Propulsion:	batteries
Endurance:	2hrs
Max. speed:	13Km/h
Payload:	250Kg

2.1.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency	2400 - 2500

range:	
Power:	100 mWatts
Modulation:	OFDM
Number of channels:	16

Type:	UMTS/GSM
Frequency:	dynamic
Possible frequency range:	876-960, 1710-1880, 1920-1980, 2110-2120
Power:	250 mWatts
Modulation:	GMSK/8PSK/QPSK/16QAM

Type:	Wideband Radio Modem
Frequency:	160 MHz
Possible frequency range:	157-160
Power:	25000 mWatts
Modulation:	2GMSK
Number of channels:	128

Type:	COFDM Video Transmitter
Frequency:	370 MHz
Possible frequency range:	250-390
Power:	1000 mWatts
Modulation:	QPSK
Number of channels:	15

Type:	Emergency Halt System
Frequency:	433.3
Possible frequency range:	433-435
Power:	10 mWatts
Modulation:	FM
Number of channels:	64

2.1.3 Sensors equipment

Laser:	1x Velodyne HDL-32E 2x Sick LMS 511
Vision:	Self-manufactured 360°-Cam with dual ACTI 4x-MPEG4 video grabbers
GPS:	OxTS RT3002
Inertial measurement unit:	OxTS RT3002

2.1.4 Computing equipment on vehicle

Number of computers:	1
Number of CPUs:	4
Type of CPU:	Intel Core 2 Duo QX9600
Operating system(s):	Linux

2.1.5 Basic data about control station

Pictures of the control station:

Number of operators (mandatory/optional):	1/1
Number of computers:	1
Number of CPUs:	2
Type of CPU:	Intel Core Duo
Operating system:	Linux
Space needed for control station:	200x200x250cm LWH
Weight of control station:	10kg
Power source needed:	none, 230V optional

2.2 Vehicle Specification Sheet Team FKIE

Pictures of the vehicle:

front left

front right

Name of vehicle: Kutusow

2.2.1 Basic data about vehicle

Height:	141cm (Total height from ground to top, including antennas etc.)
Height:	141cm (Total height from ground to top of the vehicle)
Width:	115cm
Length:	178cm
Weight:	350kg
Ground clearance:	15cm
Average noise level:	30 dB(A) (approx.)
Climbing performance:	45 degree
Wheel or track driven:	wheel
Propulsion:	batteries
Endurance:	2hrs
Max. speed:	13Km/h
Payload:	250Kg

2.2.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency	2400 - 2500

range:	
Power:	100 mWatts
Modulation:	OFDM
Number of channels:	16

Type:	UMTS/GSM
Frequency:	dynamic
Possible frequency range:	876-960, 1710-1880, 1920-1980, 2110-2120
Power:	250 mWatts
Modulation:	GMSK/8PSK/QPSK/16QAM

Type:	Wideband Radio Modem
Frequency:	160 MHz
Possible frequency range:	157-160
Power:	25000 mWatts
Modulation:	2GMSK
Number of channels:	128

Type:	COFDM Video Transmitter
Frequency:	370 MHz
Possible frequency range:	250-390
Power:	1000 mWatts
Modulation:	QPSK
Number of channels:	15

Type:	Emergency Halt System
Frequency:	433.575
Possible frequency range:	433-435
Power:	10 mWatts
Modulation:	FM
Number of channels:	64

2.2.3 Sensors equipment

Laser:	1x Velodyne HDL-64E 1x Hokuyo UTM-30LX 1x Sick LMS 512
Vision:	Self-manufactured 360°-Cam with dual ACTI 4x-MPEG4 video grabbers
GPS:	OxTS RT3002
Inertial measurement unit:	OxTS RT3002

2.2.4 Computing equipment on vehicle

Number of computers:	1
Number of CPUs:	4
Type of CPU:	Intel Core 2 Duo QX9600
Operating system(s):	Linux

2.2.5 Basic data about control station

Pictures of the control station:	
Number of operators (mandatory/optional):	1/1
Number of computers:	1
Number of CPUs:	2
Type of CPU:	Intel Core Duo
Operating system:	Linux
Space needed for control station:	200x200x250cm LWH
Weight of control station:	10kg
Power source needed:	none, 230V optional

2.3 Vehicle Specification Sheet Team FKIE

Pictures of the vehicle:

front left

front right

Name of vehicle: Gneisenau

2.3.1 Basic data about vehicle

Height:	120cm (Total height from ground to top, including antennas etc.)
Height:	120cm (Total height from ground to top of the vehicle)
Width:	70cm
Length:	100cm
Weight:	80kg
Ground clearance:	5cm
Average noise level:	30 dB(A) (approx.)
Climbing performance:	45 degree
Wheel or track driven:	wheel
Propulsion:	batteries
Endurance:	3hrs
Max. speed:	3Km/h
Payload:	25Kg

2.3.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency	2400 - 2500

range:	
Power:	100 mWatts
Modulation:	OFDM
Number of channels:	16

2.3.3 Sensors equipment

Laser:	1x Sick LMS 511
Vision:	3x Logitech QuickCam Vision Pro 9000
GPS:	Topcon Legacy E+
Inertial measurement unit:	PNI TCM

2.3.4 Computing equipment on vehicle

Number of computers:	1
Number of CPUs:	2
Type of CPU:	Intel Core 2 Duo T7600
Operating system(s):	Linux

2.3.5 Basic data about control station

Pictures of the control station:	 
Number of operators (mandatory/optional):	1/1
Number of computers:	2
Number of CPUs:	4
Type of CPU:	Intel Core Duo
Operating system:	Linux
Space needed for control station:	570x200x254cm LWH
Weight	2000kg
Power source needed:	none, 230V optional

3 Team Information THEOC

Pictures of vehicle:

Defender D2.1

Digital Vanguard

Picture of team leader:

Name of team leader:	Dave Norton
Team Name:	THEOC
Team E-mail:	dave.norton@allenvanguard.com
Website:	www.allenvanguard.com
Location:	
Institution/Company:	Allen-Vanguard Ltd
Address:	Allen House Alexandra Way Ashchurch Business Park Tewkesbury Gloucestershire GL20 8TD United Kingdom
Telephone:	+44 (0)1684 851185
Fax:	+44 (0)1684 851101

Team Description:	The THEOC Team is Allen-Vanguard's entry into the ELROB2012. The team is composed of a mixture of individuals and backgrounds. These include research and design, manufacturing, sales and product managing. Two of the team are former bomb technicians having completed a number of operational tours of duty. We intend to show two ROVs, the Vanguard and its larger sibling Defender, both platforms are battery powered and tele-operated. The Vanguard is classified in the small category of ROVs weighing 56 kg and has a superlative tracked drive system complimented by a six DOF arm assembly. The heavier Defender weighs 275 kg, its drive is delivered by six independent electric motors utilising an innovative chassis assembly. Traction is gained via six wheels, as with the Vanguard the Defender has six DOF as standard. Both systems are supplied as standard with WLAN Tx system transmitting at 2.4 GHz Our intention is to demonstrate both systems in the EOD scenario.
Sponsors:	-
Selection of scenario:	1. Reconnaissance and surveillance _X_ 2. Camp security ___ 3. Transport ___ 4. Mule __ 5. EOD _X_

3.1 Vehicle Specification Sheet Team THEOC, Defender D2.1 Vehicle

Pictures of the vehicle:




Name of vehicle: Defender D2.1 Vehicle

3.1.1 Basic data about vehicle

Height:	150 cm (Total height from ground to top, including antennas)
Height:	115 cm (Total height from ground to top of the vehicle)
Width:	72.5 cm
Length:	152 cm
Weight:	330 kg (including all accessories)
Ground clearance:	10 cm
Average noise level:	-
Climbing performance:	45 degree
Wheel or track driven:	Wheel; six wheels independently driven
Propulsion:	2 x Apollo 12v DC batteries
Endurance:	4hrs
Max. speed:	2.5 km/h
Payload:	275Kg

3.1.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency range:	from 2400 to 2484 MHz
Power:	100 mW – 1W
Modulation:	Digital Sequence Spread Spectrum (DSSS) / (CCK)
Number of channels:	14

3.1.3 Sensors equipment

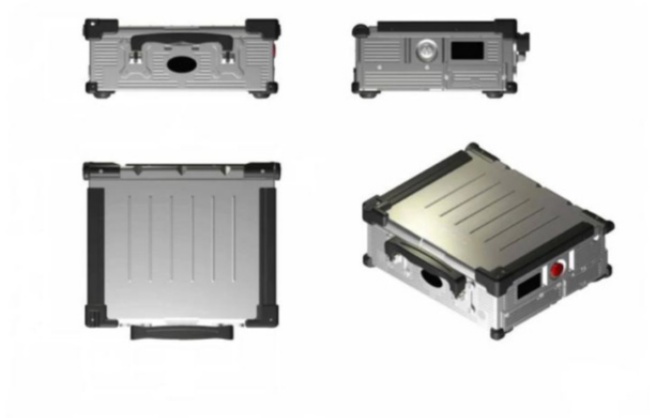
Laser:	-
Vision:	6 CCD Cameras fitted as standard: Front Drive - Wide angle “Starlight” CCD Camera Rear Drive - Wide angle “Starlight” CCD Camera Turret - A wide angle monochrome camera with IR illumination Surveillance - VISCA controlled colour CCD Camera mounted on a pan & tilt unit with an x40 zoom capability Claw - VISCA controlled colour CCD Camera mounted on a pan & tilt unit with an x40 zoom capability Auxiliary - Bullet monochrome camera for use on the claw and other accessories
GPS:	Garmin GPS-16. Average accuracy 100 cm
Inertial measurement unit:	-

3.1.4 Computing equipment on vehicle

Number of computers:	0
Number of CPUs:	1
Type of CPU:	PIC Microprocessor (16F877)
Operating system(s):	Propriety

3.1.5 Basic data about control station

Pictures of the control station:



Number of operators (mandatory/optional):	1
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel P M, 1.4-1.8 GHz
Operating system:	Windows XP SP.2
Space needed for control station:	299 x 333 x 134 mm (L/W/H)
Weight of control station:	8.6 kg
Power source needed:	115/230 volts

3.2 Vehicle Specification Sheet Team THEOC, Digital Vanguard

Pictures of the vehicle:

Name of vehicle: Digital Vanguard

3.2.1 Basic data about vehicle

Height:	56 cm (Total height from ground to top, including antennas etc.)
Height:	56 cm (Total height from ground to top of the vehicle)
Width:	46 cm
Length:	104 cm
Weight:	58 Kg
Ground clearance:	5.75 cm
Average noise level:	-
Climbing performance:	45 degree as standard *subject to suitable traction
Wheel or track driven:	Track as standard, can be fitted with a Wheel Kit
Propulsion:	24v battery pack
Endurance:	4 hrs
Max. speed:	2.5 Km/h
Payload:	250Kg

3.2.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency range:	from 2400 to 2484
Power:	100 mW – 1W
Modulation:	DSSS/CCK (Direct Sequence Spread Spectrum / Complementary Code Keying)
Number of channels:	11

3.2.3 Sensors equipment

Laser:	-
Vision:	3 CCD Cameras as standard Drive - A wide angle CCD camera Surveillance - A VISCA controlled CCD camera mounted on a Pan & Tilt unit with an x40 zoom capability. Claw - A CCD camera suited for use with the ROVs claw A fourth camera can be fitted this is either a dedicated disruptor camera or a CCD camera with IR illumination.
GPS:	-
Inertial measurement unit:	-

3.2.4 Computing equipment on vehicle

Number of computers:	None
Number of CPUs:	1 x PIC microprocessor
Type of CPU:	PIC microprocessor
Operating system(s):	Firmware only

3.2.5 Basic data about control station

Pictures of the control station:

Number of operators (mandatory/optional):	1
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel P M 1.8GHz
Operating system:	Windows XP SP2
Space needed for control station:	299 x 333 x 134 mm (L/W/H)
Weight of control station:	8.6 kg
Power source needed:	115/230 Volts

4 Teaminformation Team ELP

Pictures of vehicle:

Name of vehicle:	PackBot EOD, SUGV 310

Picture of team leader:

Name of team leader:	Colin Weiss
Team Name:	ELP
Team E-mail:	elp@elp-gmbh.de
Website:	http://www.elp-gmbh.de
Location:	Wuppertal
Institution/Company:	ELP GmbH European Logistic Partners
Address:	Nuetzenberger Str. 359 42115 Wuppertal / Germany
Telephone:	++49-202-69894-0
Fax:	++49-202-69894-10

Team Description:

Since establishment in 1989, ELP GmbH has been involved with the needs of military and police bomb disposal units and their very special equipment. At first the focus was set mainly in the field of remote controlled manipulation equipment such as hook and line sets and remote controlled vehicles.

Portable x-ray equipment, ballistic protective devices and drugs- and explosives detection instruments were soon incorporated into our offered range of products.

Being closely involved in the conception and design of such equipment as well as developing our own designs and patents, we now provide state of the art products for the very special needs and requirements found in this area of safety and security minded applications.

By offering training as well as technical support, workshop maintenance and repair facilities, we stride to maintain the high standard of expectations of our long time customers.

The PackBot EOD is a rugged, lightweight robot designed to conduct Explosive Ordnance Disposal, hazardous material handling (HAZMAT), search and surveillance, hostage rescue and other vital law enforcement tasks for bomb squads, SWAT-teams and military units.

The vehicle weighs less than 24 kg fully loaded, it can be hand carried and deployed by a single operator. In its stowed position, the robot can quickly load into the trunk of a squad car and transported to site.

Once deployed, the PackBot EOD can traverse narrow, difficult hard-to access-terrain at burst speed up to 10 km/h. The robot can quickly penetrate inaccessible and dangerous areas. PackBot EOD is equipped with tracked QuickFlip dual rotating flippers that allow the robot to easily climb stairs, manoeuvre over rocks and rubble and navigate narrow, twisting passages. The robot’s flexible ToughTrack polymer tracks can eject debris and manoeuvre over any surface – from tiled floor to snow and mud – with “human-like” dexterity. This all-weather, all terrain robot goes virtually anywhere.

The chassis offers eight separate payload bays, each with interchangeable payload modules such as video/audio, chemical-bio sensors, minedetectors, ground penetrating radar (GPR) and extra power.

The Omni reach manipulator arm can access targets other robots cannot. And with its powerful, low profile gripper, the robot can perform a wide array of

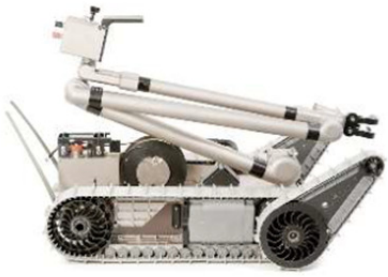
	manipulation tasks. The PackBot EOD is simple to lean and use. The ruggedized Operator Control Unit has an ergonomic design with intuitive controls and preprogrammed positions and modes to ease stress for an optimum mission success. The same applies for the SUGV 310, the “smaller Brother” of the PackBot.
Sponsors:	-
Selection of scenario:	1. Reconnaissance and surveillance _X_ 2. Camp security ___ 3. Transport ___ 4. Mule __ 5. EOD _X_

4.1 Vehicle Specification Sheet Team ELP, PackBot 510 EOD

Pictures of the vehicle:






Name of vehicle: PackBot 510 EOD

4.1.1 Basic data about vehicle

Height:	2210 cm (Total height from ground to top, Arm extended)
Height:	40.7 cm (Total height from ground to top, Arm stowed, including flexible Antennas)
Width:	40.6 cm without Flippers, 52 cm with flippers
Length:	69 cm with flippers stowed, 88.9 cm with flippers extended
Weight:	24 kg (excluding batteries), 33.3 kg (incl. Batteries and FO-Spooler)
Ground clearance:	7.62 cm
Average noise level:	-
Climbing performance:	Stairs (with 5 kg additional) payload: 43° on wood, 38° on carpet, 40° on metal
Wheel or track driven:	track
Propulsion:	batteries (Examples: batteries, fuel, solar, nuclear etc.)
Endurance:	12 – 15 hrs.
Max. speed:	Max. speed: 9.3 km/h
Payload:	35 kg

4.1.2 Communication equipment

Type:	WLAN 802.11g Alternative Radio: Type: WLAN 802.11a Frequency: 4900 MHz Power: 400 mW Modulation: OFDM Number of Channels: 11
Frequency:	2400 MHz
Possible frequency range:	-
Power:	400 mW max, 100 mW CE
Modulation:	OFDM
Number of channels:	11, fixed to channel 6 on 2.4 GHz Band

4.1.3 Alternative Radio:

Type:	WLAN 802.11a
Frequency:	4900 MHz
Possible frequency range:	-
Power:	400 mW
Modulation:	OFDM
Number of channels:	11

4.1.4 Sensors equipment

Laser:	-
Vision:	4 Colour Cameras, 1 of them 312x zoom and low light mode one input for an auxiliary camera (FLIR or Wide-Angle as per mission requirements)
GPS:	optional, depending on system configuration Inertial measurement unit:
Inertial measurement unit:	Built-in, includes magnetic compass, pitch and roll sensors
Joint position and movement:	Absolute and relative encoders
Other sensors (auxiliary):	X-Ray imaging (Real-time and Image-Plate), HazMat Sensor kit (Radiation, Chemical Warfare Agents, Toxic industrial chemicals, Oxygen concentration, temperature, humidity), Explosives detection kit

4.1.5 Computing equipment on vehicle

Number of computers:	1 fixed (Main Computer), second modular (User Assist Payload)
Number of CPUs:	1 each
Type of CPU:	Intel P III 1GHz
Operating system(s):	Linux

4.1.6 Basic data about control station

Pictures of the control station:

Number of operators (mandatory/optional):	1
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Core2 Duo Mobile T5500, 2 x 1.66 GHz (Dual-Core)
Operating system:	Linux
Space needed for control station:	352 x 284 x 64 cm LWH
Weight of control station:	6 kg
Power source needed:	230 Volts with 150 Watt when operating on mains power

4.2 Vehicle Specification Sheet Team ELP, SUGV 310

Pictures of the vehicle:

Name of vehicle: SUGV 310

4.2.1 Basic data about vehicle

Height:	89.7 cm (total height from ground to top; Arm in maximum extension)
Height:	22.9 cm (Total height from ground to top; Arm in stowed position)
Width:	43.7 cm with Flippers installed, 34.8 cm with Flippers removed
Length:	70.8 cm (Flippers stowed)
Weight:	13.2 kg (with no payloads)
Turning diameter:	within own length
Average noise level:	-
Climbing performance:	84 degree (depending on friction)

Wheel or track driven:	track
Propulsion:	batteries (Examples: batteries, fuel, solar, nuclear etc.)
Endurance:	6 – 7 hrs.
Max. speed:	6.2 km/h
Payload:	5 kg

4.2.2 Communication equipment

Type:	WLAN 802.11g
Frequency:	2400 MHz
Possible frequency range:	-
Power:	400 mW max, 100 mW CE
Modulation:	OFDM
Number of channels:	11, fixed to channel 6 on 2.4 GHz Band

4.2.3 Alternative Radio:

Type:	WLAN 802.11a
Frequency:	4900 MHz
Possible frequency range:	-
Power:	400 mW
Modulation:	OFDM
Number of channels:	11

4.2.4 Sensors equipment

Laser:	-
Vision:	4 Colour Cameras, 1 of them 40x zoom and low light mode
GPS:	optional, depending on system configuration
Inertial measurement unit:	Built-in, includes magnetic compass, pitch and roll sensors
Joint position and movement:	Absolute and relative encoders
Other sensors:	IR Distance measurement sensor mounted next to gripper camera

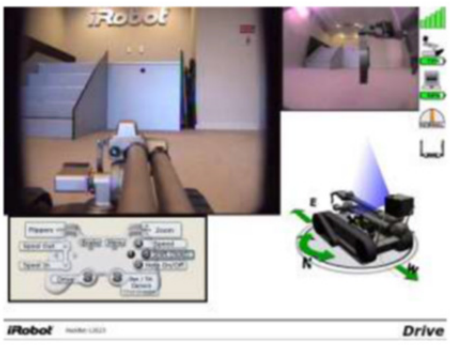
4.2.5 Computing equipment on vehicle

Number of computers:	1
Number of CPUs:	1
Type of CPU:	Pentium III, 1GHz
Operating system(s):	Linux

4.2.6 Basic data about control station

Pictures of the standard Backpack control station:

Pictures of the optional Laptop-based control station:



Number of operators:	1
Number of computers:	1
Number of CPUs:	1

Type of CPU:	Intel Core2 Duo Mobile T5500, 2 x 1.66 GHz (Dual-Core)
Operating system:	Linux
Space needed for control station:	352 x 284 x 64 cm LWH for Laptop control station Backpack controller does not need extra space when worn
Weight of control station:	approx. 6 kg
Power source needed:	230 Volts with 150 Watt when operating on mains power

5 Team Information ZKpfmBesBw

Picture of team leader:

Name of team leader:	Björn Wilhelm
Team Name:	ZKpfmBesBw
Team E-mail:	bjoern1wilhelm@bundeswehr.org
Website:	www.bundeswehr.de
Location:	Stetten am kalten Markt, Germany
Institution/Company:	Zentrum für Kampfmittelbeseitigung der Bundeswehr
Address:	Hardtstraße 58 72510 Stetten am kalten Markt
Telephone:	+49-7573-504-3000

Team Description:

The “ZKpfmBesBw” team consists of 4 EOD – specialists.

All of them are also trained in IEDD.

Experiences of multiple deployments abroad and the different training- possibilities were the basis for the development of the parcour.

5.1 Vehicle Specification Sheet Team ZKpfmBesBw

Name of vehicle: Fernlenkmanipulator, klein (PackBot)

5.1.1 Basic data about vehicle

Height:	407mm
Width:	508mm
Length:	879mm
Weight:	24kg
Climbing performance:	60°
Wheel or track driven:	track
Propulsion:	batteries
Endurance:	2-12 std
Max. speed:	2m/s
Payload:	16kg

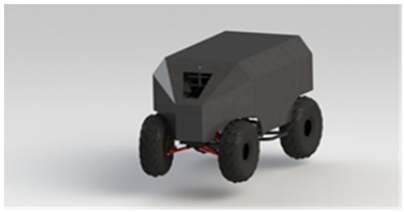
5.1.2 Communication equipment

Type:	WLAN-PCMCIA-Card
Frequency:	2437 MHz
Possible frequency range:	from 2437 to 2437 MHz
Power:	100 mW
Modulation:	DSSS
Number of channels:	1

6 Team Information RESCUE ISTY

Pictures of vehicle:






Modeling robot motorcycle purchased commercially

Name of vehicle: MX5 RQM (Mantes eXplorer 5 Robot Quad militaire)

Picture of team leader:

Name of team leader:	Hay Stéphane
Team Name:	RESCUE ISTY
Team E-mail:	hay.s@wanadoo.fr
Website:	www.rescue.free.fr
Location:	Institut des sciences et techniques des Yvelines
Institution/Company:	Mantes la Villes
Address:	63 Boulevard Roger Salengro 78711Mantes la ville

Telephone:	+33 1 34 78 88 90
Fax:	+33 1 34 78 88 91
Sponsors:	SKF, S2M, IGUS, SERVALY, SEICO,
Selection of scenario:	1. Reconnaissance and surveillance _YES_ 2. Camp security __YES_ 3. Transport _YES__ 4. Mule _YES_ 5. EOD NO

Team Description:	We are a group of students in mechatronics that started this robot in 2010. We bought a rolling basis to develop trade with the robot MX5 design of mechanical, electronic and computer home. The robot is controlled remotely with a radio remote control and video information and measuring instruments are transmitted by wireless laision. We also thought about all the safety to avoid accidents in case of loss of control of the robot. This robot can be used in urban terrain and difficult. In hot or cold. In times of rain or snow.
Sponsors:	SKF, S2M, IGUS, SERVALY, SEICO
Selection of scenario:	1. Reconnaissance and surveillance _YES_ 2. Camp security __YES_ 3. Transport _YES__ 4. Mule _YES_ 5. EOD NO

6.1 Vehicle Specification Sheet Team RESCUE ISTY

Pictures of the vehicle:





Name of vehicle: MX5 (Mantes eXplorer 5)

6.1.1 Basic data about vehicle

Height:	150cm with antennas
Height:	120cm
Width:	90cm
Length:	110cm
Weight:	130Kg (Including all accessories)
Ground clearance:	15cm
Average noise level:	80 dB(A) (approx.)
Climbing performance:	45 degree
Wheel or track driven:	engine thermal
Propulsion:	Fuel
Endurance:	24hrs
Max. speed:	Max. speed: 70Km/h
Payload:	Payload: 70Kg

6.1.2 Communication equipment

6.1.2.1 WIFI

Type:	WLAN 802.11g
Frequency:	2,4GHZ
Possible frequency range:	10/100MBit/s
Power:	10.000 mWatts
Modulation:	UDP TCP/IP
Number of channels:	1

6.1.2.2 RF command

Type:	radiofrequency command
Frequency:	41MHz
Possible frequency range:	from 40MHz to 41MHz
Power:	12Vdc 225mA
Modulation:	PPM (FM)
Number of channels:	8 and 4 trimmers

6.1.2.3 RF vision

Type:	radiofrequency command
Frequency:	1,3GHz
Possible frequency range:	from 1,2GHz to 1,3GHz
Power:	850mW
Modulation:	FM
Number of channels:	12

6.1.3 Sensors equipment

Laser:	-
Vision:	1* RF camera 1,3GHz 850mW, receiver 12 ch mounted on a pan/tilt system. 1* Axis camera Ethernet: 270° rotation, Zoom*12 with Pan/tilt system. 1* camera in order mule function with reconnaissance vision software

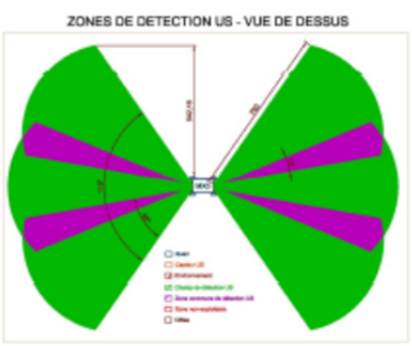
	1* camera Ip Trendnet.
GPS:	Nauticom: Pocket PC Palm HI-206III Sirf3
Radar:	MAX Sonar EZ1 *10 (5 behind and 5 above)
Inertial measurement unit:	system maked with WII motion + and Nunchuk Nintendo. Home made.

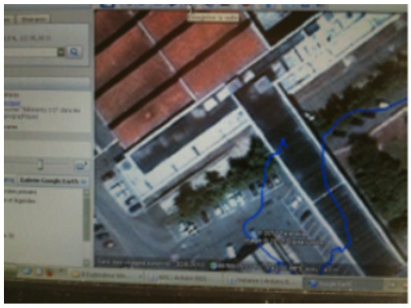
6.1.4 Computing equipment on vehicle

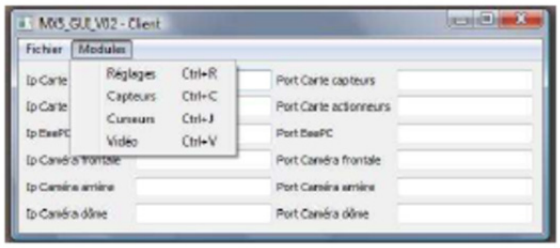
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Atom Processor N450 (1,66GHz, 512kB cache)
Operating system(s):	Windows XP

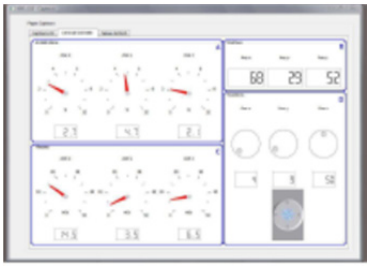
6.1.5 Basic data about control station

Pictures of the control station:









Number of operators (mandatory/optional):	2/6
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Atom Processor N450 (1,66GHz,512kB cache)
Operating system:	Linux (Example: Linux, Windows XP etc.)
Space needed for control station:	300x400x250cm LWH (Example: Container, laptop etc.)
Weight of control station:	12kg
Power source needed:	230Volts with 1600Watts

7 Teaminformation Macro USA

Pictures of vehicle:








Name of vehicle: Beetle Nano-UGV, Armadillo M-UGV and Controller , Scorpion S-UGV

Picture of team leader:	
Name of team leader:	Cino Robin Castelli
Team Name:	MacroUSA
Team E-mail:	macrousa@gmail.com Tel.: Fax.: Email: rcastelli@macrousa.com Web: www.macrousa.com M-Swiss Consulting S.A. Via Generoso, 7 CH-6830 Lugano Switzerland Tel.: +41.79.651.15.01 Email: mswiss.consulting@gmail.com
Website:	www.macrousa.com
Location:	USA/Switzerland
Institution/Company:	MacroUSA Corp./M-Swiss Consulting S.A.
Address:	MacroUSA Corp. 5930 Price Avenue McClellan Air Force Base McClellan CA 95652 USA
Telephone:	+1 916 333 5950
Fax:	+1 916 333 5955
E-mail:	rcastelli@macrousa.com mswiss.consulting@gmail.com
Web:	www.macrousa.com M-Swiss Consulting S.A. Via Generoso, 7 CH-6830 Lugano Switzerland Tel.: +41.79.651.15.01 Email: mswiss.consulting@gmail.com
Team Description:	MacroUSA CORP. Macro USA is a Non Traditional, Small Disadvantaged, Minority and Veteran Owned Business based in McClellan Air Force Base in the USA. MacroUSA was incorporated in 2008 by a team of pro-

fessionals with over 10 years of experience in the UGV market (the technical team has been developing military UGVs since 1999).

During 2009 MacroUSA signed a multimillion dollar contract for the delivery of approximately 5000 Armadillo/Tactical Throw Camera integrated systems.

MacroUSA was also selected for the AEWE Army Expeditionary Warrior Experiment managed by the Maneuver Battle Lab (MBL) at Fort Benning, Ga., in coordination with TRADOC Army Capabilities Integration Center (ARCIC), conducts experiments through live force-on-force and constructive, virtual-land simulations. AEWE provides a repeatable, credible, validated venue for network-enabled small unit experimentation focused on emerging technologies and concepts in a live field environment providing operational insights across the DOD supporting AEWE Campaign Objectives and Tactics, Techniques and Procedures (TTP) for the current and future force. Our technology has been selected for integration and will run the experiment in Jan. and Feb. 2010.

MacroUSA has teamed with Northrop Grumman Remotec and is currently designing the mobility section of the new EOD platform for the US DoD (AEODRS, Advanced EOD Robotic System), the AEODRS platform is a JAUS compatible, modular, open architecture system that is scheduled to replace all the existing legacy small UGVs in service with the US DoD in the 2012-2014 timeframe.

In 2011 MacroUSA was awarded an initial contract in response to a JUONS (Joint Urgent Operational Needs) from JIEDDO (Joint Improvised Explosive Device Defeat Organization) to provide the US Army with an over 100 UGVs for immediate use in theatre. The follow up for the program is between 3000 and 4000 systems.

Macro USA is a member in good standing of the Robotics Technology Consortium and is working on development programs for Unmanned Ground Vehicles for the US DoD within the RPP-12 framework.

Besides SUGVs, Macro USA also offers short range throw cameras, gun cameras, portable surveillance cameras, and pole cameras.

MacroUSA's product offerings include:

• Beetle → throw-able, ultra-lightweight robotic platform that can be used for surveillance and observation.

• Armadillo → throw-able, lightweight (4 lbs.) robotic

platform that can be used for surveillance and observation. Fitted with Manipulators and several payloads for counter IED/EOD tasks.

• Scorpion → robust all terrain and stair climbing platform for use in unknown, hostile areas for reconnaissance and EOD tasks with the ability to carry payloads of 26 lbs. Base upon which the AEODRS mobility platform is being developed.

• Tracksorb → modular wheels designed to absorb impact on the vertical axis and grab onto uneven terrain to potentially climb over obstacles. Patent Pending design.

• Video cameras, Turrets, Mobile Chargers.

Our core competencies include:

• Design → includes both concept and system level design; detailed design, integration & test as well as rapid prototyping.

• Engineering → includes product design, cybernetics, industrial and ergonomics expertise.

• Manufacturing → ability to scale for small and large production runs.

• Services → offering service and maintenance agreements as well as repairs of the SUGVs.

Macro USA is strategically located on McClellan Air Force Base; the McClellan Business Park offers our Team access to various machine and fabrication shops, NDI test laboratory, Chamber test facilities as well as the "Tactical City"; this is a mock city with designated schools, buildings and other establishments that will allow our Team to test and evaluate our systems in a realistic environment.

M-Swiss Consulting S.A.

M-Swiss Consulting S.A. is a Swiss defence company specializing in Unmanned Ground Vehicles and is headed by Cino Robin Castelli.

The company holds an extensive trade and brokerage permit in Defence materiel as well as a NATO CAGE registration.

Robin is the team leader for Team MacroUSA and is responsible for the European market and initiatives.

Selection of scenario (for both platforms):

Selection of scenario:
(for both platforms)

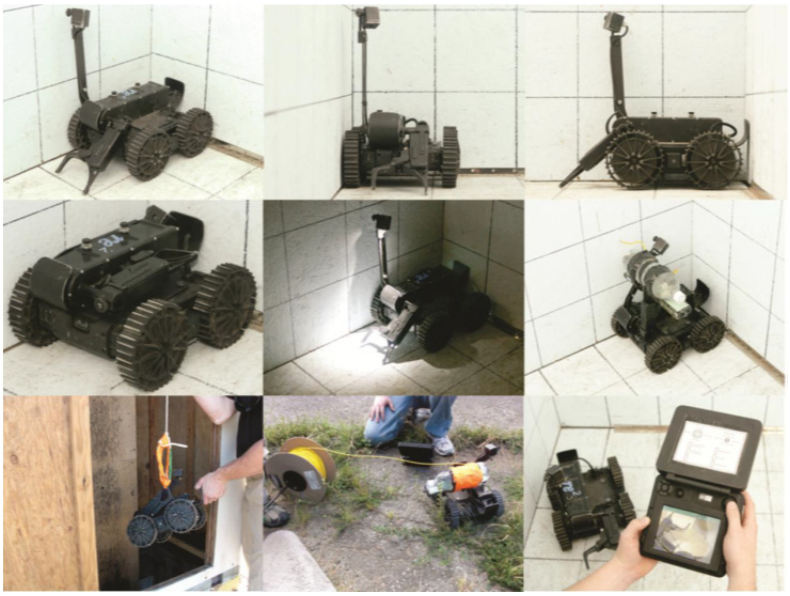
1. Reconnaissance and surveillance X

2. Transport ___

4. EOR/EOD/IEDD/CIED X

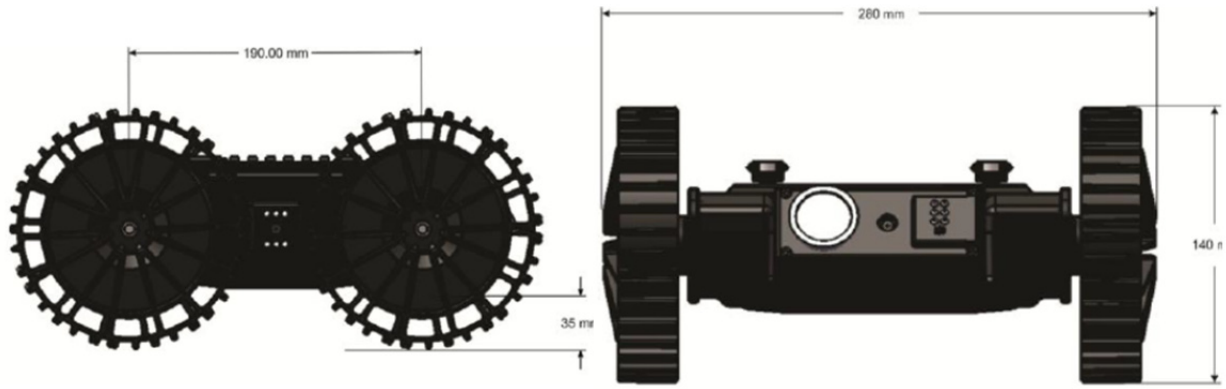
7.1 Vehicle Specification Sheet Team Macro USA, Armadillo M-UGV

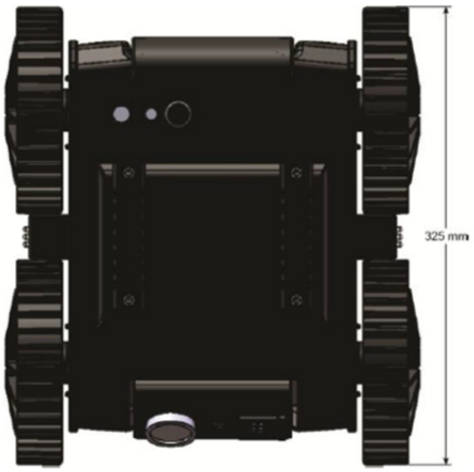
Pictures of the vehicle:



Name of vehicle: MacroUSA Armadillo M-UGV

7.1.1 Basic data about vehicle





Chassis height:	72mm
Wheel Height:	140 mm
Width:	280 mm
Length:	325 mm (including wheels)
Weight:	3.5 Kg
Ground clearance:	35 mm
Average noise level:	Not measured
Climbing performance:	45 degree
Wheel or track driven:	Tracksorb wheels
Propulsion:	batteries
Endurance:	4 hrs on battery
Max. speed:	3 Km/h
Payload:	up to 10 Kg

7.1.2 Communication equipment

Type:	Video Link
Frequency:	1.2-1.4 or 2.2-2.4 GHz
Possible frequency range:	from 1200 to 1400 MHz or 2200 to 2400 MHz
Power:	20 dBm
Modulation:	COFDM
Number of channels:	50

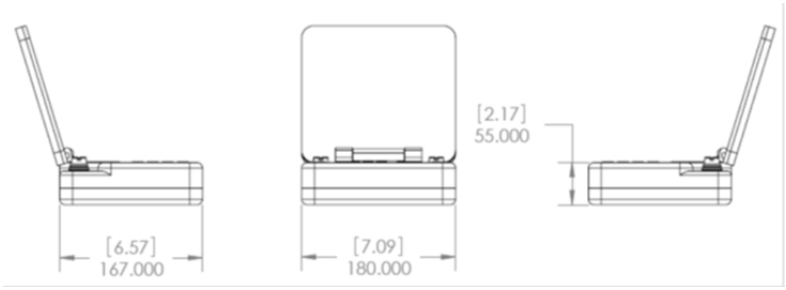
7.1.3 Sensors equipment

Laser:	-
Vision:	2 driving cameras (night day) 3 situational awareness cameras (nigh/day) to give 360 degree vision SONAR range sensor
GPS:	Internal GPS module
Mapping:	Optional SAFIRE 3D mapping sensor available
Manipulator:	Rapidly detachable 1 DOF manipulator (plus gripper)
Navigation:	Digital Magnetic Compass integral to unit
Inertial measurement unit:	Internal Accelerometer

7.1.4 Computing equipment on vehicle

Number of computers:	0
Number of CPUs:	1
Type of CPU:	DS Pic 33 series – 8MHz
Operating system(s):	Realtime OS

7.1.5 Basic data about control station

Pictures of the control station:	  
Number of operators (mandatory/optional):	1/1
Number of computers:	0
Number of CPUs:	1
Type of CPU:	Pic 24 – Microchip – 8MHz
Operating system(s):	Realtime OS
Space needed for control station:	Body worn
Weight of control station:	1.4 Kg Thickness: 65 mm Width: 180 mm Height: 167 mm
Power source needed:	Battery powered. Can be recharged from 100-250 VAC and 9-36 VDC

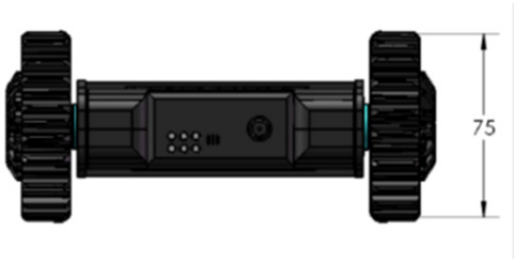
7.2 Vehicle Specification Sheet Team Macro USA, Beetle Nano UGV

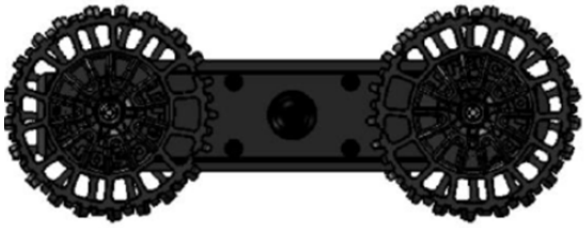
Pictures of the vehicle:

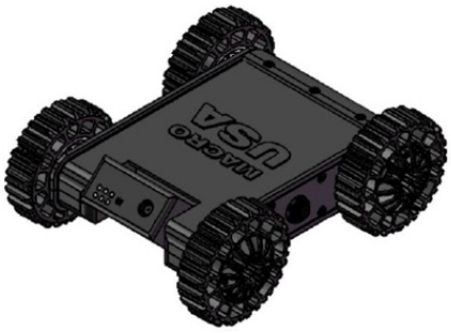



Name of vehicle: MacroUSA Armadillo M-UGV

7.2.1 Basic data about vehicle





Height:	
Wheel Height:	75 mm
Width:	175 mm
Length:	206 mm (including wheels)
Weight:	1.2 Kg
Ground clearance:	20 mm
Average noise level:	Not measured
Climbing performance:	45 degree
Wheel or track driven:	Tracksorb wheels
Propulsion:	batteries
Endurance:	1.5 hrs on battery
Max. speed:	2 Km/h
Payload:	up to 2 Kg

7.2.2 Communication equipment

Type:	Video Link
Frequency:	1.2-1.4 or 2.2-2.4 GHz
Possible frequency range:	from 1200 to 1400 MHz or 2200 to 2400 MHz
Power:	20 dBm
Modulation:	COFDM
Number of channels:	50

7.2.3 Sensors equipment

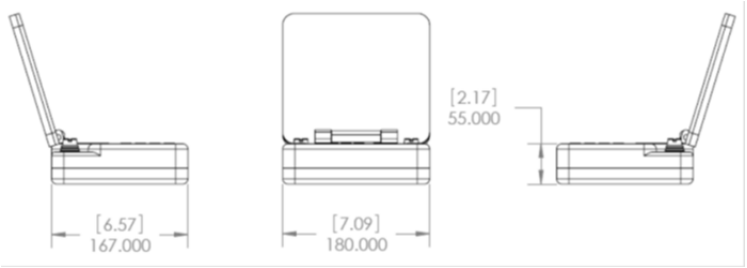
Laser:	-
Vision:	1 tilting driving camera (night day)
GPS:	Internal GPS module
Inertial measurement unit:	Internal Accelerometer

7.2.4 Computing equipment on vehicle

Number of computers:	0
Number of CPUs:	1
Type of CPU:	DS Pic 33 series – 8MHz
Operating system(s):	Realtime OS

7.2.5 Basic data about control station

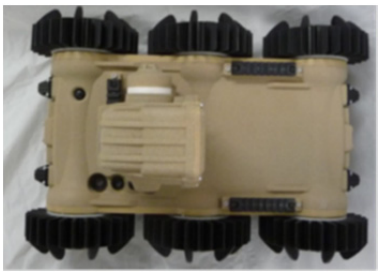
Pictures of the control station:



Number of operators (mandatory/optional	1/1
Number of computers:	0
Number of CPUs:	1
Type of CPU:	Pic 24 – Microchip – 8MHz
Operating system:	Realtime OS
Space needed:	Body worn
Weight of control station:	1.4 Kg
	Thickness: 65 mm Width: 180 mm Height: 167 mm
Power source needed:	Battery powered. Can be recharged from 100-250 VAC

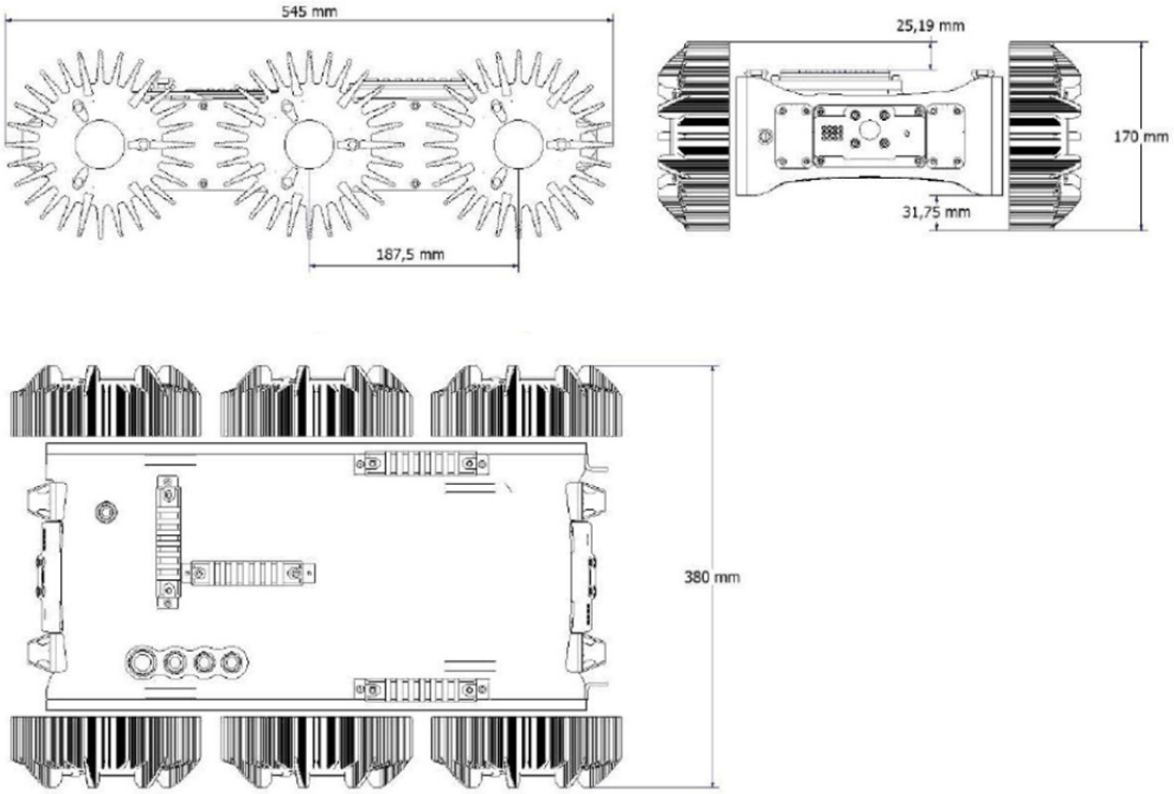
7.3 Vehicle Specification Sheet Team Macro USA, Scorpion S-UGV

Pictures of the vehicle:



Name of vehicle: MacroUSA Scorpion S-UGV

7.3.1 Basic data about vehicle



Height:	Height: 125 mm (Total height from ground to top of Chassis, not including Turret cameras if fitted) approx..
Height:	170 mm (Total height from ground to top Flapper Wheel)
Width:	386 mm (approximately)
Length:	522 mm (Chassis) (approximately)
Length:	Length: 570 mm (including Flapper Wheels)
Weight:	Under 22 kg (48,5 lb) with all systems
Ground clearance:	45 mm (approximately)
Average noise level:	Not measured
Climbing performance:	45 degree
Wheel or track driven:	Flapper wheels
Propulsion:	batteries
Endurance:	2 hrs on battery, indefinite on tether
Max. speed:	10 Km/h
Payload:	20 Kg

7.3.2 Communication equipment

Type:	Video Link
Frequency:	1.2-1.4 or 2.2-2.4 GHz
Possible frequency range:	from 1200 to 1400 MHz or 2200 to 2400 MHz
Power:	20 dBm
Modulation:	COFDM
Number of channels:	50

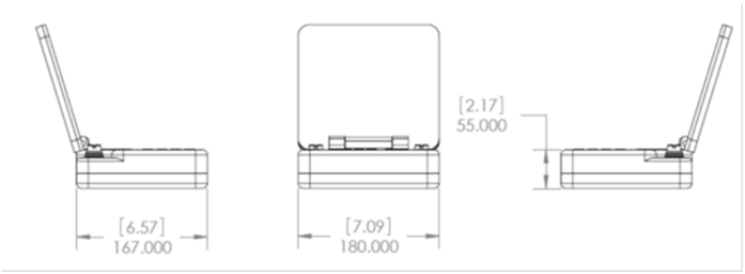
7.3.3 Sensors equipment

Laser:	-
Vision:	2 driving cameras (night day) 1 Colour Zoom Camera in turret (night/day, 27x Optical Zoom) 1 Thermal Imaging Camera in turret (320x240 Pixel, Thermoteknix, 4x digital zoom)
GPS:	Optional GPS modules available
Navigation:	Digital Magnetic Compass integral to unit
Inertial measurement unit:	Internal Accelerometer

7.3.4 Computing equipment on vehicle

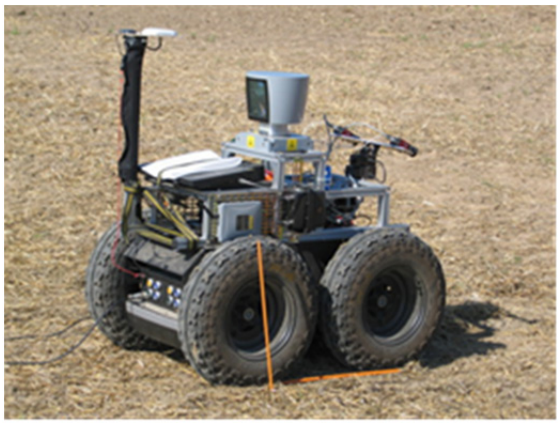
Number of computers:	0
Number of CPUs:	1
Type of CPU:	DS Pic 33 series – 8MHz
Operating system(s):	Realtime OS

7.3.5 Basic data about control station

Pictures of the control station:	  
Number of operators (mandatory/optional):	/1
Number of computers:	0
Number of CPUs:	1
Type of CPU:	Pic 24 – Microchip – 8MHz
Operating system:	Realtime OS
Space needed for control station:	Body worn
Weight of control station:	1.4 Kg Thickness: 65 mm Width: 180 mm Height: 167 mm
Power source needed:	Battery powered. Can be recharged from 100-250 VAC and 9-36 VDC

8 Teaminformation Marbel

Picture of vehicle:



Name of vehicle: Mana

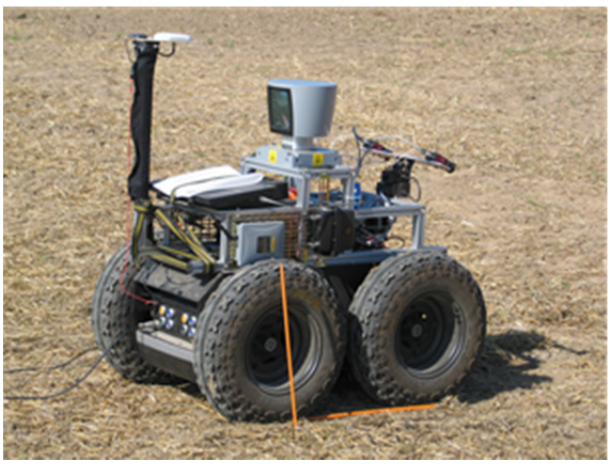
Picture of team leader:

Name of team leader:	Simon Lacroix
Team Name:	Marble
Team E-mail:	elrob-2012@laas.fr
Website:	
Location:	Toulouse, France
Institution/Company:	LAAS/CNRS
Address:	7, Avenue du Colonel Roche F-31077 Toulouse Cedex 4
Telephone:	+33 561 33 62 66
Fax:	+33 561 33 64 55
Team Description:	Autonomous mobile robotics has been a research topic studied at LAAS/CNRS since the late 70's. We have always favored a constructive and integrative way of

	thinking robotics, aiming at defining robotics as a wholesome scientific discipline. A wide variety of problems are studied: environment perception and modeling, path planning, task planning, task execution control, motion control, decisional architecture, heterogeneous multi-robots systems, learning, human robot interaction... In field robotics, our focus is currently on aero-terrestrial multi-robot systems. Our vehicle is the rover Mana, a SegWay RMP400 that has been equipped at LAAS with a stereovision bench, a Velodyne Lidar, a solid-state inertial measurement unit and a fiber-optic gyro. The main robotics functionalities we aim at demonstrating cover the wide range of classical functions related to autonomous navigation: robot localization, terrain mapping, motion generation.
Sponsors:	No sponsors (yet)
Selection of scenario:	1. ISR (both Approach and Reconnoitre) 2. Transport/Mule

8.1 Vehicle Specification Sheet Team Marble

Pictures of the vehicle:



Name of vehicle: Mana

8.1.1 Basic data about vehicle

Height:	120 cm (Total height from ground to top, including antennas etc.)
Height:	100 cm (Total height from ground to top of the vehicle)
Width:	80 cm
Length:	115 cm
Weight:	130 Kg (Including all accessories)
Ground clearance:	10 cm
Average noise level:	??? dB(A) (not noisy)
Climbing performance:	45 degree
Wheel or track driven:	wheel
Propulsion:	Lithium-ion batteries
Endurance:	8hrs
Max. speed:	30Km/h (this speed will never be reached in autonomous mode)
Payload:	90Kg

8.1.2 Communication equipment

8.1.2.1 Wifi connection

Type:	WLAN 802.11a
Frequency:	5.2 GHz
Possible frequency range:	from 5.15 to 5.35 GHz
Power:	600 mWatts
Modulation:	64 QAM
Number of channels:	13

8.1.2.2 Emergency stop

Type:	FM
Frequency:	433.92 MHz
Possible frequency range:	433.90 / 434.10
Power:	10 mW
Modulation:	FM
Number of channels:	2

8.1.2.3 GPS corrections transmission

Type:	Serial Modem
Frequency:	868
Possible frequency range:	869.40 / 869.65
Power:	250 mW
Modulation:	SF FSK
Number of channels:	1

8.1.3 Sensors equipment

Laser:	1 Velodyne HDL-64E Lidar
Vision:	2 x Marlin F131-B FireWire cameras mounted on a Directed Perception Pan&Tilt unit
GPS:	Novatel OEM4 RTK-DGPS. Average accuracy 2.0cm
Gyro:	1 KVH E-Core 5000 Fiber-optic gyrometer
Inertial measurement :	xSens MTi attitude

8.1.4 Computing equipment on vehicle

Number of computers:	2
Number of CPUs:	2
Type of CPU:	Intel Pentium M @ 1.8 Ghz and Intel Core 2 Duo @ 3.06 GHz
Operating system(s):	Linux

8.1.5 Basic data about control station

Pictures of the control station:	Not available yet (one laptop with an extension screen)
Number of operators (mandatory/optional):	1/3
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Core 2 Duo
Operating system:	Linux
Space needed for control station:	300x400x250cm LWH (A table with room for three laptops)
Weight of control station:	A few kgs
Power source needed:	230Volts with 500Watts

9 Teaminformation Hochschule Offenburg

Pictures of vehicle:

Name of vehicle:	ALF90 petrol engine (RF-Helicopter)	ALF75 electric engine (Reconnaissance-Helicopter)

Picture of team leader:

Name of team leader:	Prof. Dr. Werner Schröder
Team Name:	Hochschule Offenburg
Team E-mail:	w.schroeder@hs-offenburg.de
Website:	www.hs-offenburg.de
Location:	Offenburg
Institution/Company:	Institute for Unmanned Aerial Systems (IUAS) from the University of Applied Sciences Offenburg
Address:	Badstr.24 77652 Offenburg
Telephone:	+49-0171-3110678
Fax:	+49-0781-205-214

Team Description:	The team “Hochschule Offenburg” consists of the Institute for Unmanned Aerial Systems, which is located at a university of applied research with about 3800 students. We have developed a light weight and low power flight control system for model helicopters. At the Elrob 2012 we like to fly with two partly autonomous helicopters in tandem configuration. One of the helicopters is used as an RF-relay for the low flying reconnaissance helicopter equipped with cameras. The helicopters have fuel / electric engines with a dry weight of about 8 kg (fuel) and 6 kg (electric). They are equipped with an AHRS, an INS with GPS-augmentation and a flight control computer. The reconnaissance helicopter will be flown according to the camera images sent from the helicopters to the ground station. In order to hold the RF-connection, the RF-relay helicopter will autonomously fly above the reconnaissance helicopter. In order to hold the RF-link, the RF-relay helicopter has to fly in line-of-sight of the ground station. The flight altitude above ground of the RF-relay helicopter depends on the shape of the area. The ground station uses a tracking antenna with patch/parabola antennas and is equipped with monitors and the control systems.
Sponsors:	University of Applied Sciences Offenburg
Selection of scenario:	1. Reconnaissance and surveillance 2. EOR/EOD/IEDD/CIED

9.1 Vehicle Information Sheet Team Hochschule Offenburg

Pictures of the vehicle:

ALF90 (RF-Helicopter)

ALF75 (Reconnaissance-Heli-copter)

Name of vehicle: ALF

9.1.1 Basic data about vehicle

9.1.1.1 RF-Helicopter

Height:	65cm (Total height from ground to top, including antennas etc.)
Height:	65cm (Total height from ground to top of the vehicle)
Width:	180cm (rotor diameter)
Length:	208cm
Weight:	12kg (Including all accessories)
Ground clearance:	NA
Average noise level:	<89 dB(A) (approx.)
Climbing performance:	8m/s
Wheel or track driven:	NA
Propulsion:	fuel
Endurance:	1.5hrs
Max. speed:	80km/h
Payload:	-

9.1.1.2 Reconnaissance-Helicopter

Height:	56cm (Total height from ground to top, including antennas etc.)
Height:	56cm (Total height from ground to top of the vehicle)
Width:	150cm (rotor diameter)
Length:	178cm
Weight:	10Kg (Including all accessories)
Ground clearance:	NA
Average noise level:	75dB(A) (approx.)
Climbing performance:	10m/s
Wheel or track driven:	NA
Propulsion:	batteries
Endurance:	0.5hrs
Max. speed:	100Km/h
Payload:	-

9.1.2 Communication equipment

9.1.2.1 Video link:

Type:	WLAN 802.11n
Frequency:	5 GHz nominally
Possible frequency range:	from 5.47 GHz to 5.725 GHz
Power:	<1000 mW
Modulation:	OFDM
Number of channels:	11

9.1.2.2 Data link and remote control:

Type:	DNT2400 (RFM) 2.4 GHz FHSS
Frequency:	2.4 GHz
Possible frequency range:	from 2.409 GHz to 2.467 GHz
Power:	68 mW
Modulation:	FKS / MSK
Number of channels:	11

9.1.2.3 Alternative remote control:

Type:	Spektrum DX7 remote control for model helicopter
Frequency:	2.4 GHz
Possible frequency range:	from 2.4 GHz to 2.5 GHz

9.1.3 Sensors equipment

Ultrasonic:	some ultrasonic distance sensors to detect objects in the near
Optical Sensor:	two triangular distance sensor whit analog output
Vision:	2 or 3 IP-Cameras on the reconnaissance helicopter 1 or 2 IP-Cameras on the RF helicopter
GPS:	GPS module with active antenna
AHRS:	own development

9.1.4 Computing equipment on vehicle

Number of computers:	0
Number of CPUs:	3 (not including GPS Module, WLAN ACCES POINT, …)
Type of CPU:	RISK Processors
Operating system(s):	no available

9.1.5 Basic data about control station

Number of operators (mandatory/optional):	1/2
Number of computers:	3
Number of CPUs:	3
Type of CPU:	not defined yet
Operating system:	Linux
Space needed for control station:	600x300x300cm it’s in a car
Weight of control station:	2.5 t
Power source needed:	self-sufficient

10 Teaminformation Red Eyes

Picture of vehicle:

Name of vehicle: Vortex-K

Picture of team leader:

Name of team leader:	Ass. Prof. Dmitry Bagayev
Team Name:	Red Eyes
Team E-mail:	dmitrybag@gmail.com
Website:	http://redeyes.jcod.ru, http://kpribor.edu.ru
Location:	Kovrov (Vladimir Region)
Institution/Company:	Kovrov State Technological Academy
Address:	601910, Vladimir Region, town Kovrov, str. Mayakovskogo, 19
Telephone:	+7 (49232) 32160, +7 (49232) 32099
Fax:	+7 (49232) 32160

Team Description:	The «Red Eyes» Team is Kovrov State Technological Academy entry into the ELROB-2012. The team is largely composed of faculty and students from Kovrov State Technological Academy School of Engineering, under the leadership of Ass. Prof. Dmitry Bagayev (Head of the Science Laboratory «IT in Robotics») and chief engineer Dmitry Lapygin (Research Associate of the Science Laboratory «IT in Robotics»). The «Red Eyes» Team is supported by a consortium of corporations and private donors located in the Russia Area and elsewhere. Our machine is called «Vortex-K». «Vortex-K» was created based on the ATV and includes on-board computers, system of motor control, control system sensors, vision system, GPS. Our vehicle worck under control of on board computer system. All processing takes place using software developed in the Science Laboratory «IT in Robotics». During movement, the environment is perceived through two laser range finders, a stereo of camera, and monocularvision system. All sensors acquire environment data at speeds of 10 to 100 Hz. Map and report are included in the 10 Hz, which allows «Vortex-K», to avoid collisions with obstacles in real time as you goalong ELROB-2012 route. The development of the Vortex-K system began in December 2011. Team «Vortex-K» winner to Russia's first race of robotic avtonomobiley «Robokross-2010».
Sponsors:	-
Selection of scenario:	1. Reconnaissance and surveillance X 2. Camp security -- 3. Transport -- 4. Mule X 5. EOD --

10.1 Vehicle Specification Sheet Team Red Eyes

Pictures of the vehicle:

Name of vehicle: Vortex-K

10.1.1 Basic data about vehicle

Height:	2500 cm (Total height from ground to top, including antennas etc.)
Height:	1800 cm (Total height from ground to top of the vehicle)
Width:	150 cm
Length:	180 cm
Weight:	400 Kg (Including all accessories)
Ground clearance:	20 cm
Average noise level:	120 dB(A) (approx.)
Climbing performance:	45 degree
Wheel or track driven:	wheel
Propulsion:	fuel (Examples: batteries, fuel, solar, nuclear etc.)
Endurance:	6 hrs
Max. speed:	25 Km/h
Payload:	250 Kg

10.1.2 Communication equipment

Type:	WLAN 802.11g/n
Frequency:	2400 MHz
Possible frequency range:	from 2400 to 3000
Power:	10.000 mWatts
Modulation:	OFDM
Number of channels:	16

10.1.3 Sensors equipment

Laser:	2 x Sick Laser LMS 200
Vision:	-
GPS:	Trimble HDS0815 DGPS using 3x diversity antennas. Average accuracy 0,45cm.
Radar:	-
Inertial measurement unit:	Crossbow Getit DH7

10.1.4 Computing equipment on vehicle

Number of computers:	2
Number of CPUs:	3
Type of CPU:	Intel P III 1GHz and AMD Opteron 4GHz
Operating system(s):	Windows XP (Example: Linux, Windows XP etc.)

10.1.5 Basic data about control station

Number of operators (mandatory/optional):	3/12
Number of computers:	2
Number of CPUs:	3
Type of CPU:	Intel P III 1GHz and AMD Opteron 4GHz
Operating system:	Windows XP (Example: Linux, Windows XP etc.)
Space needed for control station:	300x400x250cm LWH (Example: Container, laptop etc.)
Weight of control station:	-
Power source needed:	230 Volts with 1600 Watts

11 Teaminformation RI Spirit

Picture of vehicle:

Name of vehicle: RI A-Bot Light & RI A-Bot Standard

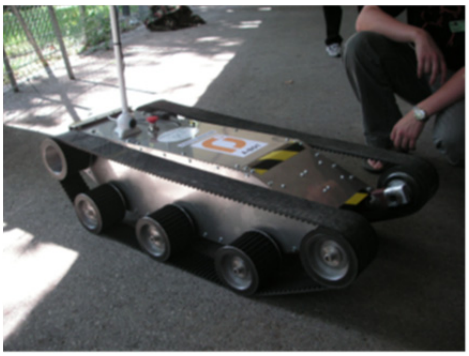
Picture of team leader:

Name of team leader:	Marek Sadowski
Team Name:	RI Spirit
Team E-mail:	elrob@roboticsinventions.com
Website:	www.roboticsinventions.com
Location:	Warsaw, Poland
Institution/Company:	Robotics Inventions
Address:	Marynarska 14, 02-674 Warsaw, Poland
Telephone:	+48-888-333-627

Team Description:	Robotics Inventions is a New Product Development company delivering in 6 months preproduction prototypes (including Bill of Material), excelling in fully- and semi-autonomous robots, vision systems, the autonomy module RI SPIRIT, the robot swarm management system RI FLEET, innovative user interfaces and various components, having a dedicated production facility, as well as the robotics professional services. Our mission is to design and manufacture semi- and fully-autonomous robots and its parts to allow human tele-presence in harsh and extraterrestrial environments as well as to undertake dangerous & repetitive tasks on human behalf. Moreover we offer RI Professional Services to companies and organizations seeking support in designing and implementing solutions that require dedicated electronics, mechanical constructions, automatics, robotics, autonomous software and artificial intelligence. In addition Robotics Inventions aspire to deliver a flexible autonomous component to animate any hardware. Robotics Inventions strategy is in peaceful applications of the robotics for the better present and future of all human kind. Founded in 2004 the company is based in Warsaw, Poland. Research & Development is led by Marek Sadowski, an International Space University alumnus, a former vice president of Polish Astronautics Society, and a former researcher at NASA Ames Research Center on robotics 3D control systems and a Java researcher at Nippon Telegraph and Telephone Software Laboratories in Tokyo. Public Sector Relations are maintained by Monika Krzyzanowska, a former Vice President & Business Development Executive at Thales International Poland. In 2012 the company gathered 32 investors both private and institutions.
Sponsors:	None
Selection of scenario:	1. ISR_____ 2. Mule_____ 3. Move_____ 4. _____

11.1 Vehicle Specification Sheet Team RI Spirit, A-BOT Standard

Pictures of the vehicle:



Name of vehicle: A-BOT Standard

11.1.1 Basic data about vehicle

Height:	125 cm Total height from ground to top, including antennas)
Height:	37 cm (Total height from ground to top of the vehicle)
Width:	51 cm
Length:	101 cm
Weight:	100 kg (Including all accessories)
Ground clearance:	10 cm
Average noise level:	60 dB(A) (approx.)
Climbing performance:	35 degree
Wheel or track driven:	track
Propulsion:	batteries
Endurance:	2 h
Max. speed:	15 km/h
Payload:	90kg

11.1.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency range:	2400 to 2800
Power:	10 mWatts(20dbm)
Modulation:	--
Number of channels:	13

11.1.3 Sensors equipment

Laser:	2 x Digital Camera
GPS:	2 x
Ultrasonic sensors:	12 x
Lidar:	1 x

11.1.4 Computing equipment on vehicle

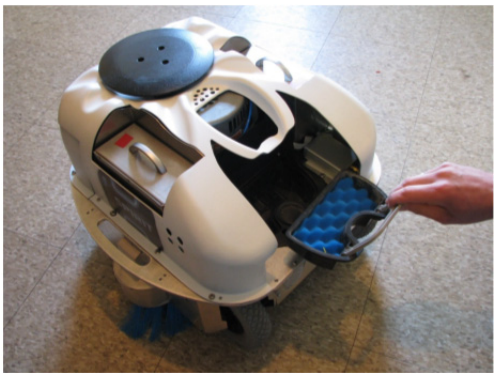
Number of computers:	2
Number of CPUs:	2
Type of CPU:	ARM
Operating system(s):	Linux

11.1.5 Basic data about control station

Pictures of the control station:	Laptop
Number of operators (mandatory/optional):	1/1
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Pentium Mobile 2GHz
Operating system:	Linux
Space needed for control station:	300x400x250cm LWH
Weight of control station:	2 kg
Power source needed:	230Volts with 600Watts

11.2 Vehicle Specification Sheet Team RI Spirit, A-BOT Standard, RI A-BOT light

Pictures of the vehicle:



Name of vehicle: A-BOT Standard

Pictures of the vehicle:

Name of vehicle: RI A-BOT light

11.2.1 Basic data about vehicle

Height:	40 cm Total height from ground to top, including antennas)
Height:	40 cm (Total height from ground to top of the vehicle)
Width:	55 cm
Length:	55 cm
Weight:	35 kg (Including all accessories)
Ground clearance:	5 cm
Average noise level:	50 dB(A) (approx.)
Climbing performance:	25 degree
Wheel or track driven:	wheel

Propulsion:	batteries
Endurance:	5 h
Max. speed:	10 km/h
Payload:	5kg

11.2.2 Communication equipment

Type:	WLAN 802.11b
Frequency:	2400 MHz
Possible frequency range:	2400 to 2800
Power:	10 mWatts(20dbm)
Modulation:	-
Number of channels:	13

11.2.3 Sensors equipment

Vision:	2 x Digital Camera
GPS:	1 x
Ultrasonic sensors:	8 x
Lidar:	1 x

11.2.4 Computing equipment on vehicle

Number of computers:	2
Number of CPUs:	2
Type of CPU:	ARM
Operating system(s):	Linux

11.2.5 Basic data about control station

Pictures of the control station:	Laptop
Number of operators (mandatory/optional):	1/1
Number of computers:	1
Number of CPUs:	1
Type of CPU:	Intel Pentium Mobile 2GHz
Operating system:	Linux
Space needed for control station:	300x400x250cm LWH (Example: laptop etc.)
Weight of control station:	2 kg
Power source needed:	230Volts with 600Watts

12 Teaminformation telerob

Picture of vehicle:

Name of vehicle:	teleMAX teleMAX

Picture of team leader:

Name of team leader:	Dr. Andreas Ciossek
Team Name:	telerob
Team E-mail:	ciossek@telerob.de
Website:	www.telerob.de
Location:	Germany
Institution/Company:	telerob Gesellschaft für Fernhantierungstechnik mbH
Address:	Vogelsangstrasse 8 73760 Ostfildern
Telephone:	++49-0711-34102-115
Fax:	++49-0711-34102-555

Team Description:	To develop machines, equipment and systems that protect or replace human beings in situations where their presence would be either impossible or place them at great risk. This is the motto, motivation and mission of telerob Gesellschaft für Fernhantierungstechnik mbH. Whether it's one of our Master- Slave Manipulators being used to dismantle a nuclear facility or an EOD robot being used to disarm a dangerous explosive device, protecting people and their surroundings is always our paramount concern anytime one of our products is deployed. Our engineers and specialists in the fields of electrical engineering, electronics and precision mechanical engineering combine creativity and competence in the quest for advanced solutions in the worlds of bomb disposal and remote handling technology. The telerob range of products encompasses EOD robots (tEODor and teleMAX), completely equipped bomb disposal vehicles (TEL600), bomb disposal equipment, non-magnetic special tools (NOMATOOLS), as well as manipulators for servicing, maintaining and dismantling nuclear facilities (EMSM). A highly qualified, highly motivated staff provides our worldwide client base not merely with innovative products developed and manufactured in accordance with the very highest standards but also with the training and instruction needed to ensure their effective use. telerob is an official NATO supplier and development partner (NATO supplier code: C 5152). Furthermore we conform to the requirements of AQAP 2130.
Sponsors:	none
Selection of scenario:	1. Reconnaissance and surveillance – Approach _X_ 2. Reconnaissance and surveillance – Camp Security _X_ 3. Transport – Movements ___ 4. Transport – Mule ___ 5. EOD _X_

12.1 Vehicle Specification Sheet Team elrob

Pictures of the vehicle:

Name of vehicle: teleMAX

12.1.1 Basic data about vehicle

Height:	75 cm
Width:	40 cm
Length:	80 cm
Height:	2600 cm maximum vertical reach position
Length:	160 cm flipper horizontally extended
Weight:	80 Kg base system
Ground clearance:	depends on configuration
Average noise level:	-
Climbing performance:	45 degree
Wheel or track driven:	4 tracks
Propulsion:	battery
Endurance:	up to 4 hrs
Max. speed:	up to 5 Km/h
Payload:	10 Kg

12.1.2 Communication equipment

12.1.2.1 Data communication link 1:

Type:	Radio
Frequency:	434 MHz
Possible frequency range:	from 433 to 435 MHz
Power:	up to 1000 mWatts
Number of channels:	80

12.1.2.2 Data communication link 2 (optional):

Type:	Fibre optical

12.1.2.3 Video feedback:

Type:	Radio
Frequency:	2353 MHz
Possible frequency range:	from 2353 to 2381 MHz
Power:	5000 mWatts
Number of channels:	5

12.1.3 Sensors equipment

Vision:	1 x colour camera with 10 x optical zoom, auto focus and integrated LED illumination. 3 x fixed focus colour camera with LED illumination 1 x fixed focus colour camera Further optional cameras
Radiation:	Thermo Electron RadEye-PRD or other.
Gas:	Dräger Xam7000 or other.
GPS:	Garmin 16-HVS. Average accuracy 15m.
CWA, TIC:	N.N.

12.1.4 Computing equipment on vehicle

Number of computers:	1
Operating system(s):	VxWorks

12.1.5 Basic data about control station

Pictures of the control station:	 Mercedes Benz Sprinter 518CDI
Number of operators (mandatory/optional):	1/3
Number of computers:	3
Number of CPUs:	
Type of CPU:	
Operating system:	Windows
Space needed for control station:	Size of the Sprinter: 7500 x 2500 x 3200 cm LWH
Weight of control station:	5000 Kg
Power source needed:	not necessary - optional 230Volts with 1600Watts

13 Teaminformation MuCAR

Picture of vehicle:

Name of vehicle: MuCAR-3

Picture of team leader:

Name of team leader:	Prof. Dr.-Ing. Hans-Joachim “Joe” Wuensche
Team Name:	MuCAR
Team E-mail:	joe.wuensche@unibw.de
Website:	http://www.unibw.de/lrt8
Location:	Munich
Institution/Company:	University of the Bundeswehr Munich
Address:	LRT 8 TAS 85577 Neubiberg
Telephone:	+49-(0)89 – 6004 – 3588
Fax:	+49-(0)89 – 6004 – 3074

Team Description:	Team MuCAR develops and operates MuCAR-3, and is headed by Prof. Dr.-Ing. H.-J. Wuensche, chair for “Autonomous Systems Technology” and head of the identically named institute. Our vehicle is named “MuCAR-3”, the third generation of our Munich Cognitive, Autonomous Robot Cars. The first two vehicle generations drove on German Autobahns under the leadership of Prof. Dickmanns as far back as 1987; both vehicles have retired to museums. MuCAR-3 is based on a stock VW Touareg with a V6 TDI engine, modified to allow computer control of steering, brake, throttle and automatic gearbox. Full body skid plates allow testing in rough terrain. Apart from inertial sensors we continue to focus on vision as a main sensor for perception, as this sensor provides most of the information humans need for driving. In addition we use a high definition 360 degree Laser Scanner mounted on the roof of the vehicle. It is advantageous in special applications such as off-road driving, until our vision systems can fully cope with those scenarios as well. The main vision sensors are 3 forward looking cameras placed on a twoaxis platform inside the vehicle. The arrangement resembles the human vision system, with a tele-camera as “fovea” and 2 slightly outward pointed wide angle cameras for peripheral vision. All cameras are mounted on a yaw axis platform to allow for active control of the horizontal viewing direction, while the view of the tele-camera with its narrow field of view is inertially stabilized. Our robust and fast 4D-approach to perception has been augmented by an innovative fusion of vision and lidar data and excels in offroad environments featuring poor GPS conditions. Team MuCAR participated at the ELROB 2007, ELROB 2008, ELROB 2009 and ELROB 2010 and – together with TU Karlsruhe and TU Munich through Team AnnieWAY – at the DARPA Urban Challenge 2007, where this team was one of only 11 teams which made it into the finals on 3 Nov. 2007.
Sponsors:	None
Selection of scenario:	1. Reconnaissance (Approach) 2. Transport Movements 3. Transport Mule

13.1 Vehicle Specification Sheet Team MuCAR

Pictures of the vehicle:

Name of vehicle: MuCAR-3

13.1.1 Basic data about vehicle

Height:	205 cm (Total height from ground to top of the vehicle with Laserscanner mounted on roof: ca. 240 cm)
Width:	193 cm
Length:	480 cm
Weight:	2800 kg (Including all accessories)
Ground clearance:	30cm
Average noise level:	81 dB(A) (approx.)
Climbing performance:	45 degree
Wheel or track driven:	4 wheel drive
Propulsion:	fuel (Diesel) (Volkswagen 3.0 ltr V6 TDI engine)
Endurance:	8 hrs
Max. speed:	205 Km/h
Payload:	>250 kg

13.1.2 Communication equipment

Wireless Radio Modem:	optional, for use with a local D-GPS base station only
Wireless LAN:	optional, for communication between multiple vehicles only

13.1.3 Sensors equipment

Vision:	3 cameras with wide-angle & tele-lens, mounted on custom build 2 axis platform inside the vehicle
Lidar:	Velodyne HDL64E-S2 3D LIDAR System
INS:	OxTS RT3003: Full 6 DOF IMU system with integrated D-GPS system
MEMS Gyros:	1 for inertial camera pitch axis stabilisation

13.1.4 Computing equipment on vehicle

Vehicle Control:	dSpace Autobox
Camera platform:	dSpace MicroAutobox
Central Vehicle Computer:	Double Hexa Core Intel Xeon System used for - Vision analysis, feature extraction and object detection - Situation analysis and behaviour decision - Path-Planning - Attention Selection
Operating system(s):	Linux

13.1.5 Basic data about control station

Control station is mounted inside the vehicle. No external control station.

14 Team Information WFD

Picture of vehicle:

Name of vehicle: HOBO

Picture of team leader:

Name of team leader:	Matthias Baumer
Team Name:	WFD
Team E-mail:	andreas.wegmann@for-zh.ch
Website:	www.wfd-srs.ch
Location:	Zürich
Institution/Company:	Wissenschaftlicher Forschungsdienst WFD/Scientific Research Service SRS
Address:	Zeughausstrasse 31 CH-8004 Zürich
Telephone:	+41 44 411 97 24
Fax:	+41 44 411 97 09

Team Description:	The Scientific Research Service, administratively located at the Zurich City Police, is the criminalistic expert body of the Swiss Confederation and, therefore, of the Federal Police Force and is primarily active in the field of explosives. Among other tasks the SRS is in charge of rendering inert/safe improvised explosive devices in Switzerland. Our robot vehicle is a HOBO L3A1 and was produced in 2000 in Ireland by Kentree Ltd, Kilbrittain/Cork. It has been completely upgraded in 2011. The vehicle is either radio- or wire-controlled.
Sponsors:	-
Selection of scenario:	1. IEDD

14.1 Vehicle Specification Sheet Team WFD

Pictures of the vehicle:

Name of vehicle: HOBO

14.1.1 Basic data about vehicle

Height:	1400cm (Total height from ground to top, including antennas etc.)
Height:	1200 cm (Total height from ground to top of the vehicle)
Width:	70cm
Length:	170cm
Weight:	250kg
Ground clearance:	10cm
Average noise level:	60 dB(A) (approx.)
Climbing performance:	42 degree
Wheel or track driven:	wheels
Propulsion:	batteries
Endurance:	3hrs
Max. speed:	5Km/h
Payload:	75Kg

14.1.2 Communication equipment

Type:	
Frequency:	2400 MHz
Possible frequency range:	from 2280 to 2550
Power:	1.000 mWatts
Modulation:	COFDM
Number of channels:	

14.1.3 Sensors equipment

Vision:	4 x Sony cameras (drive, reverse, pan/tilt, claw)
other	Highly sensitive radioactivity monitoring system for safe checks of areas and objects.

14.1.4 Basic data about control station

Pictures of the control station:

Number of operators (mandatory/optional):	
Number of computers:	
Number of CPUs:	
Type of CPU:	
Operating system:	
Space needed for control station:	500x400x200cm LWH (Peli 1515)
Weight of control station:	20kg
Power source needed:	Batteries for 2 hrs, or 230Volts with 500Watts

Exhibitors

15 Exhibitor Information KB Videosystems GmbH

Name of team leader:	Rainer Böttcher
Team Name:	KB Videosystems GmbH
Team E-mail:	boettcher@kb-videosystems.com
Website:	www.kb-videosystems.com
Location:	Germany
Institution/Company:	KB Videosystems GmbH
Address:	Döcklitzer Tor 36 06268 Querfurt Germany
Telephone:	+49 34771 717053
Fax:	+49 34771 717054

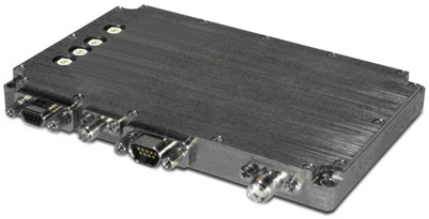
Team Description:

KB Videosystems GmbH is supplier of high quality video surveillance systems made by exclusive valued manufacturers. Our product range goes from thermal imaging surveillance cameras, compact wireless video and data transmission systems, optical communication equipment to very specific DVRs for vehicle integrations. All products are designed according to military standards, so that the user can rely on a perfect performance even in harsh environments and rough applications.

Please visit our website to see and to find out the possibilities with our:

- thermal imaging cameras made by Opgal Optronic Industries, the manufacturer based in Israel with more than 30 years of experience in the field of military and authority systems

- COFDM video/IP-data transmission systems, which AMP manufactures according to the medical/aerospace standards



- STACK DVR 3, the shock and vibration proof digital recorder with many additional functions for mobile applications.

16 Exhibitor Information progenoX

Name of team leader:	Woodcock Frank
Team Name:	progenoX GmbH
Team E-mail:	frank.woodcock@progenox.com
Website:	www.progenox.com
Location:	Bavaria or Germany
Institution/Company:	progenoX GmbH
Address:	Im Pfaffenfeld 6 83483 Bischofswiesen
Telephone:	+49-8652 6553377
Fax:	+49-8652 6553379

Team Description:

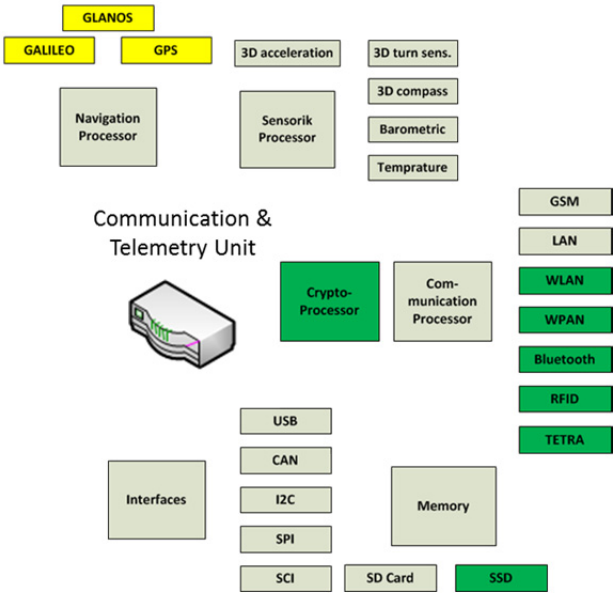
progenoX is an innovative system house providing solutions for homeland security and defence.

Within our fields of products we deliver customer oriented solutions for Robotics, information and communication technology, localization, navigation and identification, supply and support, product lifecycle management, training and simulation.

icosX integration – communication – orientation – sensing

icosX is a system which can be retrofitted to existing UGVs to upgrade and enhance the functionality and usability of UGVs. icosX supports on-board sensors and an expandable variety of interfaces for data exchange and communication. IcosX enables you retrofitting existing UGV platforms with new or state of the art sensors and actors.

The system is designed to be easy implemented and adapted to your use.



16.1 Vehicle Specification Sheet Team progenoX

Pictures of the vehicle:

16.1.1 Basic data about vehicle

Vehicle Name	IBIS
Height:	950 mm
Width:	850 mm
Length:	1.300 mm
Weight:	295 kg
Max. speed:	10 km/h

16.2 Vehicle Specification Sheet Team progenoX

Pictures of the vehicle:

16.2.1 Basic data about vehicle

Vehicle Name	SCOUT
Height:	190 mm
Width:	530 mm
Length:	750 mm
Weight:	27,5 kg
Max. speed:	7 km/h

17 Exhibitor Information Optimess

Picture of vehicle:

Name of vehicle:	iSnoop ®
Name of team leader:	Mr. Eberhard Credo (Dipl.-Phys.)
Team Name:	Optimess
Team E-mail:	info@rescue-robotics.net
Website:	www.rescue-robotics.net
Location:	Germany
Institution/Company:	OPTIMESS Engineering GmbH
Address:	Gewerbepark Keplerstr. 10-12 07549 Gera
Telephone:	+49 365 4319459
Fax:	+49 365 4319458

Team Description:

OPTIMESS Engineering GmbH, a medium-sized enterprise, has been established in the early 1990s. For more than 20 years innovate robotic systems for various civil and military applications have been developed, designed and manufactured.

Our most important field of products is the reconnaissance robotics for military forces and security forces as well as for the management of environmental and natural disasters.

iSnoop® robot provides applications for military use, SWAT-teams, security firms, Fire departments and Disaster Management Organisations for search and rescue.

It is assumed that the demand for reconnaissance

robots, which serve as security for task forces during their operations, will increase significantly.

Robots for reconnaissance enhance the effectivity of military missions without further increase of task forces' stress.

Our rugged and cross-country robots iSnoop® can be thrown, e.g. in constructions like buildings, rooms, … and helps to estimate the on-site situation.

Applications for remote supervision by iSnoop® are for example:

- Investigation of rooms, buildings, roofs
- Inspection of undercarriages
- Support during reconnaissance in cavities and funkholes

iSnoop® robots increase the success, to locate imminent dangers and provide information, that save lives.

17.1 Vehicle Specification Sheet Team Optimess

Pictures of the vehicle:

Name of vehicle: iSnoop ®

You can throw it through a window, in a cavity, over a wall, ... - iSnoop® Throw it! will be ready to go on the spot.
The movement of iSnoop® Throw it! is remote controlled by portable control unit.
Realtime video transfer will enable you to realize fast, efficient and safe rescue operations.
Camera's pan shot function enables you to view in the last corners.
Integrated gas sensors will check for gases, e.g. carbon monoxide, methane, oxygen previously, and helps to protect the rescue team during their operation. The integration of gas sensors in iSnoop® is done client-specific.

17.1.1 Basic data about vehicle

Operation range	indoors: up to 50m outdoors: up to 200m
Height:	80mm
Width:	216mm
Weight:	0.5 - 2.0kg
Max. speed:	1.3m/s (5km/h)
Operating time:	up to 120min

17.1.2 Sensors equipment

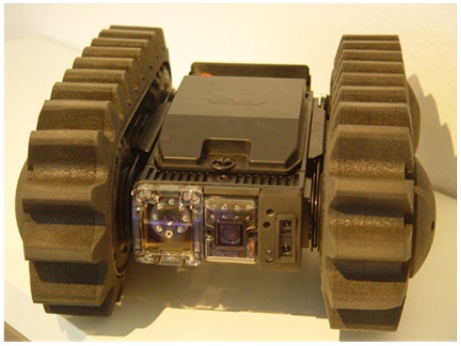
Sensors	Colour camera (PAL) or BW-camera LED-illumination (White or IR) Gas sensors for measurement of oxygen, carbon monoxide and mine gas Sound sensor

17.1.3 Basic data about control station

Control unit	several client specific control units available

18 Exhibitor Information Glückauf Logistik

Picture of vehicle:



Name of vehicle:	Eye Drive
Name of team leader:	Harald Schubert
Team Name:	Glückauf Logistik
Team E-mail:	schubert@glueckauf-logistik.de
Website:	www.glueckauf-logistik.de
Location:	Kassel
Institution/Company:	Glückauf Logistik GmbH & Co.KG
Address:	Landgraf-Karl-Straße 1 D – 34131 Kassel
Telephone:	++49-561 / 93579-0
Fax:	++49-561 / 9357944

Team Description:

The Gueckauf Logistik GmbH & Co. KG has been founded in 1988 as a subsidiary-company of the Glueckauf Hydraulic Machine Factory. Glueckauf can look back on more than 100 years successful mechanical engineering.

In 1991 Glueckauf Logistik GmbH & Co. KG became a member of the Zilch Group. Due to a continuous growth and extensive Warehouse capacities today we can offer a portfolio of more than 120.000 military spares and components. Since a few years we are also providing opto-electronical equipment for reconnaissance and surveillance.

Platform main capabilities

EyeDrive is an observation and surveillance remote-

controlled, lightweight mini-robot that provides continuous real-time 360° audio and video surveillance. Within only one hour an operator can learn to control the robot.

A single operator easily can:

- Carry and deploy the robot
- Manoeuvre it into an optimal position
- Observe & examine the scene in day, night and all weather conditions
- Track the threat

Each EyeDrive System includes:

- Mini-robot
- Communication Unit
- Laptop
- Charger and additional robot batteries
- Tactical operations vest (optional)

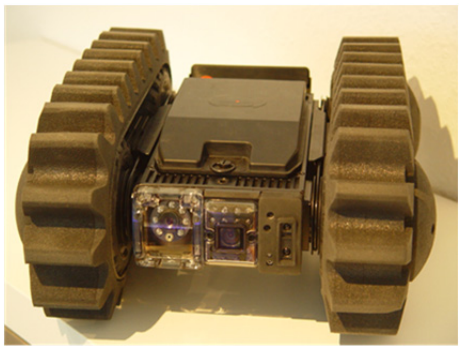
With EyeDrive´ s proprietary Point & Go navigation feature, deploying these rugged surveillance robots is intuitive and easy

The operator can remain in safe conditions when deploying and placing the remote-controlled robot. It searches into corridors and rooms prior to entry, searches under vehicles, observes and detects suspicious objects. The robot can be placed in the standby mode and activated when required. Unique Point & Go navigation directs the robot to any location by touching the location on the panoramic view on the control unit. In addition to the Point & Go navigation the robot can also be controlled by a joystick.

The robot is equipped with Video Motion Detection (VMD) providing early automatic alerts of significant events based on video and audio detection. Events can be recorded, logged and retrieved for evidence and debriefing and / or sent to remote command centre.

18.1 Vehicle Specification Sheet Team Glückauf Logistik

Pictures of the vehicle:



Name of vehicle: Eye Drive

18.1.1 Basic data about vehicle

Height:	11 cm (including antenna)
Width:	31 cm
Length:	35 cm
Weight:	3,5 kg (incl. batteries)
Turning diameter:	0 cm (turns on centre of robot)
Ground clearance:	3 cm
Climbing performance:	35%
Other:	metallic coating
Wheel or track driven:	Operator can choose between track and wheel (depending on the ground)
Propulsion:	electric
Endurance:	3 hours
Max. speed:	37 km / h
Locomotion:	(none)
Steering:	skid
Tether:	no
Control:	Remote teleoperation, line-of-sight
Manipulator:	None
Stairs:	no
Incline:	35 degrees

18.1.2 Communication equipment

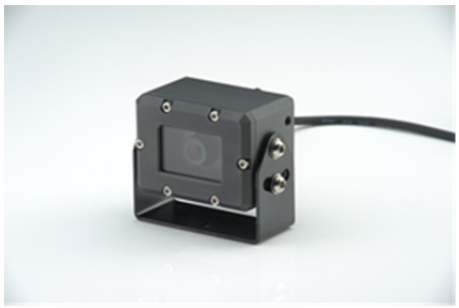
Type:	Digital video link / Digital uplink
Frequency:	2.4 GHz
Possible frequency range:	from 2.4 to 2.4 GHz
Power:	from 100mW to 250mW
Number of channels:	8

18.1.3 Sensors equipment

Laser pointer:	Red Dot

19 Exhibitor Information Motec

Picture of vehicle:



Name of vehicle:	Heavy-Duty Camera Solutions for Mobile Applications
Name of team leader:	Thomas Pietsch
Team Name:	Motec
Team E-mail:	thomas.pietsch@motec-cameras.com
Website:	www.motec-cameras.com
Institution/Company:	MOTEC GmbH
Address:	Oberweyerer Strasse 21 D-65589 Hadamar-Steinbach
Telephone:	++49 (0) 6433 9145 9512
Fax:	++49 (0) 6433 9145 45

Team Description:

In Europe, MOTEC is among the leading providers of flexible and reliable camera systems.

Since 1992 we have been developing and manufacturing cameras, monitors, radio and control units, as well as cables and plugs for challenging industrial and municipal applications, deployed in harsh and demanding environments

With more than 100 employees, our owner-managed company has successfully specialised in small and medium sized quantities.

Integrated systems, combining camera technology and sensor systems, are typical for our application and market adapted development work.

As a medium size, owner-managed company, we respond directly to our customer’s needs. Flat hierarchies with short and direct lines of communication between Sales, Development, Production and our sub-

suppliers are the basis for flexible customized solutions.

Security and Defence applications are served since around 2004 for a Swiss manufacturer of armoured vehicles and a German manufacturer of military trucks.

A first UGV-project has been realized in 2011in the frame of the German Route Clearance Package.

For more information on MOTEC , you are kindly invited to visit our website www.motec-cameras.com

20 Exhibitor Information RUAG Defence & GDELS - Mowag

Picture of vehicle:

Name of vehicle: EAGLE IV with VERO Kit installed

Name of team leader:	Dr. Hans Dünhuber
Team Name:	Team RUAG Defence & GDELS-Mowag
Team E-mail:	hans.duenhuber@ruag.com
Website:	www.ruag.com
Location:	Hallbergmoos, Germany
Institution/Company:	RUAG COEL GmbH RUAG Defence
Address:	Am Soeldnermoos 10 85399 Hallbergmoos
Telephone:	++49-08115598 230
Fax:	++49-08115598 258

Team Description:	RUAG and GDELS-Mowag (General Dynamics Land Systems-Mowag) have teamed on a project to expand the mission capabilities of the EAGLE IV vehicle by introducing the retrofittable vehicle robotics kit called VERO. VERO enables vehicle teleoperation and provides operators with the capability to conduct either manned or unmanned operations, depending on the situation and threat. The system includes a Multi Purpose Sensor (MPS) head from SAGEM which provide day and night reconnaissance and surveillance capabilities while manned or unmanned.

For ELROB, the Remote Control Centre (RCC) will be installed in a RUAG container however this functionality is also available in a single man portable backpack.

The planned stages of the project are:

A. Stage 1, Retrofit of an existing vehicle into a tele-operated vehicle. The design goal is to allow both unmanned and manned operation, using a retrofittable kit with minimal intrusion into the manned vehicle space.

B. Stage 2, take the tele-operated vehicle and expand the capabilities to allow semi-autonomous operation. This means that the vehicle drives autonomously, following both specific coordinates and taught paths, recognizes obstacles and stops before them waiting for further instructions.

C. Stage 3, the autonomous capabilities of the vehicle are expanded to detect obstacles and avoid them. This stage will include the creation of a mission planning system.

D. Stage 4, the vehicle is equipped with a system for automatic vehicle following.

The VERO Rack houses all components necessary to enable teleoperation of the vehicle. The on-board vehicle computer is the central administration/processing and control unit of the system. Communication with the Remote Control Centre (RCC) is established via the broadband RB radio system (VisCom). The driving dynamics controller (German: Fahrdynamikrechner) is process oriented and serves to avoid critical driving situations under normal operating and road/surface conditions. Normally, the Anti-lock Brake System (ABS) and Electronic Stability Program (ESP) are part of the FDR. Communication between vehicle and RCC is provided by the RB10 VisCom System and includes diversity. The Communication Computer (ComCom) combines and prepares the data in a data stream that is compatible with the radio system. Drive camera, GPS receiver and other sensors are located in a modular sensor bridge called Eagle Eye. In reconnaissance mode, camera type (infrared or video) as well as pan, tilt and zoom will be selected/operated at the control head. The video stream created by the reconnaissance platform is displayed at the Sagem MPS control unit.

21 Exhibitor Information Diehl BGT Defence

Vehicle name: TULF
MUSTANG Mk 1C

Name of team leader:	Michael MENGES
Team Name:	DIEHL Defence
Team E-mail:	Michael.JC.Menges@diehl-bgt-defence.de
Website:	www.diehl.com
Location:	Werk Röthenbach a.d. Pegnitz
Institution/Company:	Diehl BGT Defence
Address:	Fischbachstr. 16 90552 Röthenbach a.d. Pegnitz Germany
Telephone:	++49 911 957 2658
Fax:	++49 911 957 2550

Team Description:

DIEHL is a family owned German company situated in Nuremberg, Germany. DIEHL Defence as a subsidiary of the DIEHL Company is a reknown and valued industrial partner for defence forces world-wide.

The main product portfolio of DIEHL Defence focuses on seeker-guided missiles, intelligent and conventional ammunition and training systems. Furthermore DIEHL Defence has established itself in the market of reconnaissance and surveillance, protection and security with highly modern technological solutions.

In addition to those successes DIEHL Defence has gained within the last decade a high reputation within one of its new strategic domains – the sector of unmanned, autonomous systems for military purposes.

In doing so DIEHL Defence has consequently developed a platform add-on with a generic software architecture which can be adapted to basically any land based

platform. The system is based on an open software architecture which allows the implementation of existing and new autonomous capabilities, as well as existing and new sensors. The requirements of the established and certified software development process at DIEHL Defence have been followed already from the beginning – this ensures the development of software that can be introduced and utilized within military products.

The hardware displayed at this year's ELROB contain of the TULF platform, the TULF control station and the MUSTANG Mk 1C platform. Even though the platforms differ in size and weight the employed DIEHL Defence software and system architecture is basically the same. All platforms can be operated in the modes 'Manned – Teleoperated – Semi-Automous – Autonomous' using the same technological solutions.

The TULF system is realized under contract of the German Procurement Agency (Bundesamt für Wehrtechnik und Beschaffung) and contains of the displayed platform and the control station. The TULF platform is based on a HX 58 – a 27to GVW military truck produced by RMMV (Rheinmetall MAN Military Vehicle). In the first phase of the TULF study a demonstrator combining various available and proven autonomous technologies is realized. From the beginning the requirements to operate the vehicle in regular street traffic are analyzed together with experts of the German army. In the next phases the platform will be used for testing and evaluating of additional autonomous capabilities and sensors in a known environment.

The MUSTANG Mk 1C is a well proven development platform that is used by the Germany Army, the Fraunhofer Institut and DIEHL Defence. The MUSTANG Mk 1 is based on an available COTS (Commercial of the Shelf) platform and has been modified by DIEHL Defence.

Military ELROB 2012

7th European Land-Robot Trial

24-28. September, Thun, Switzerland

www.elrob.org

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Exhibition and Live Demonstrations