NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

# RESPONSE ROBOTS

## DHS/NIST Sponsored Evaluation Exercises

## Pocket Guide

**Version**
**2008.1**

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National Institute of Standards and Technology
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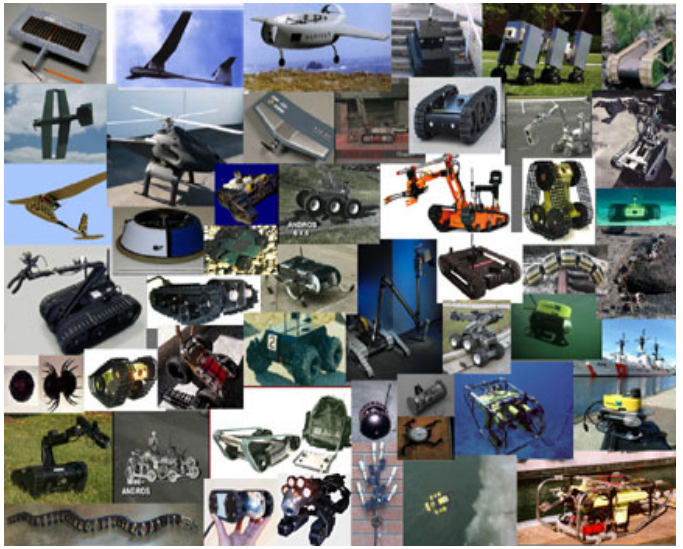
RESPONSE ROBOTS

DHS/NIST Sponsored Evaluation Exercises



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# Contacts

Intelligent Systems Division
Manufacturing Engineering Laboratory
**National Institute of Standards and Technology**
100 Bureau Drive, MS8230
Gaithersburg, MD 20899



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Gaithersburg, MD 20899

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# Program Overview

Application-specific robot standards and repeatable performance testing with objective performance metrics will accelerate the development and deployment of mobile robotic tools for US&R responders, enhancing the effectiveness of these teams while reducing the risks to personnel during disaster response. Currently, no such standards or performance metrics exist.

In order to address this need, the DHS Science and Technology (S&T) Directorate initiated an effort in fiscal year 2004 with the National Institute of Standards and Technology (NIST) to develop comprehensive standards related to the development, testing, and certification of effective robotic technologies for US&R applications. These standards will address robot mobility, sensing, navigation, planning, integration into operational caches, and human factors. Such standards will allow DHS to provide guidance to local, state, and federal homeland security entities regarding the purchase, deployment, and use of robotic systems for US&R applications.

This standards development effort focuses on fostering collaboration between US&R responders, robot vendors, and robot developers to generate consensus standards for task specific robot capabilities and interoperability of components. Furthermore, the effort includes the development and administration of technology readiness level (TRL) assessment exercises. These exercises will generate statistically significant performance data for developmental and fieldable robotic systems.



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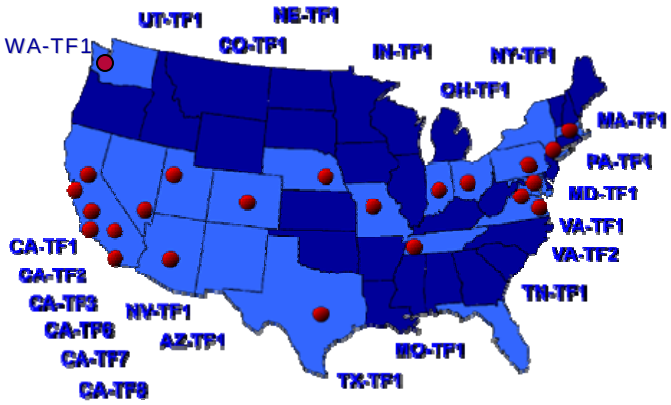
These response robot evaluation exercises for US&R teams introduce emerging robotic capabilities to emergency responders within their own training facilities, while educating robot developers regarding the necessary performance requirements and operational constraints to be effective. Emerging standard test methods and usage guides for US&R robot performance are under development within the ASTM International Committee on Homeland Security, Operational Equipment (E54.08.01). These events help refine the proposed standard test methods and fixtures/props that developers can use to practice critical capabilities and measure performance in ways that are relevant to emergency responders. These events are conducted in US&R training scenarios to help correlate the proposed standard test methods with envisioned deployment tasks and to lay the foundation for usage guides identifying a robot's applicability to particular response scenarios.

## TASK FORCE PARTICIPATION



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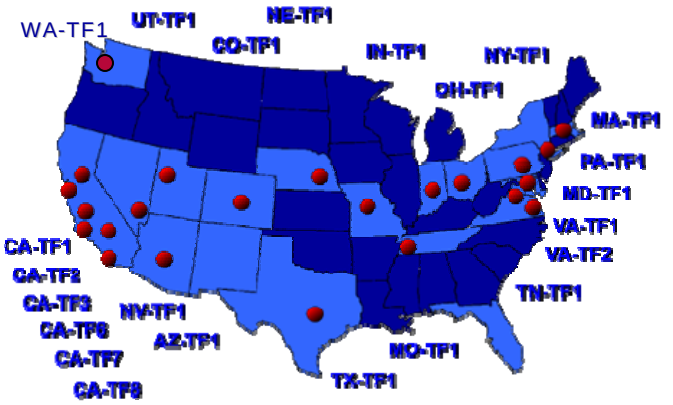

## Disaster City
## June 18-22, 2007

## Disaster City
## June 18-22, 2007

# Event Introduction

The fourth in a series of DHS/NIST Response Robot Evaluation Exercises for FEMA urban search and rescue (US&R) teams is hosted at the Texas Task Force 1 (TX-TF1) training facility known as **Disaster City** located at Texas A&M University, College Station, TX. All applicable robots were invited to take part in this exercise, which will capture robot performance data within emerging standard robot test methods and operationally relevant practice scenarios. Practice scenarios feature ground robots working in confined spaces within a partially collapsed structure along with down-range reconnaissance of two train wrecks; one a hazardous materials train and the other a passenger train from an operational stand-off greater than 150m/500ft. Other practice scenarios will also be available.

The robots used in these scenarios should deploy any or all appropriate sensors such as: color cameras, two-way audio, thermal imagers, chemical sensors, 3D mapping, GPS/GIS location, and/or other useful capabilities such as payloads, manipulators, etc. General descriptions of the robots that were sought are as follows, but are not limited to:

- Ground based portable robots that can circumnavigate large unknown situations (i.e. around the train derailments).
- Highly agile, man-packable robots that can lead responders through complex environments (i.e. the buildings and rubble piles).
- Confined space accessible robots for deployment into sub-human size voids or be thrown into/over inaccessible area
- Wall climbing robots for surveillance from elevated vantage points

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# Event Robots

| Robot Name (by size) | Company | |
|---|---|---|
| **Ground Robots** | | |
| Eyeball | Remington Tech | 53 |
| ToughBot | Omnitech Robotics | 55 |
| Active Scope Camera | Tohoku University | 59 |
| Dragon Runner | Automatika | 65 |
| BomBot | WVHTC | 67 |
| BomBot 2 | WVHTC | 69 |
| Marv | Mesa Robotics | 71 |
| Neg Tact Surv Robot | Robotic FX | 73 |
| Hero | First-Response Robotics | 75 |
| PackBot EOD | iRobot | 81 |
| PackBot Explorer | iRobot | 83 |
| Matilda | Mesa Robotics | 91 |
| Modular Log. Platform | Segway | 97 |
| Talon | Foster-Miller | 99 |
| Talon Hazmat | Foster-Miller | 101 |
| RMP 200 | Segway | 103 |
| RMP 400 | Segway | 107 |
| TeleMax | TeleRob | 111 |
| **Wall Climbers** | | |
| VMRP | Vortex | 117 |
| **Aerial Robots** | | |
| AirRobot | AirRobot | 129 |



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| Hero | First-Response Robotics | 75 |
| PackBot EOD | iRobot | 81 |
| PackBot Explorer | iRobot | 83 |
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| RMP 400 | Segway | 107 |
| TeleMax | TeleRob | 111 |
| **Wall Climbers** | | |
| VMRP | Vortex | 117 |
| **Aerial Robots** | | |
| AirRobot | AirRobot | 129 |

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## Site Map

## Site Map

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## Maryland TF-1
## August 19-21, 2006

## Maryland TF-1
## August 19-21, 2006

# Event Introduction

The third in a series of response robot informal evaluation exercises for DHS/FEMA US&R teams was hosted at the Montgomery County Fire Rescue Training Academy in Rockville, Maryland (near Washington DC). This event finalized the test methods targeted for the initial (Wave 1) set of standards as well as initiated experimentation with onboard payloads, especially for Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) sensing. Therefore, emphasis was on (a) robots that could address the deployment categories relevant to Wave 1 standards and (b) deploying CBRNE sensors on these robots. The three robot deployment categories selected by responders to be emphasized in Wave 1 are: ground peek robots that are small and throwable, ground wide-area survey robots that can traverse non-collapsed structures or areas external to the collapse, and aerial survey or loiter robots. Manufacturers of robots, purchasable and/or developmental, that can address these areas, were invited to take part in this exercise, which will highlight operationally relevant US&R scenarios.

**Maryland Task Force 1 Training Facility**

# Event Introduction

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**Maryland Task Force 1 Training Facility**

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# Event Robots


| Robot Name (by size) | Company | |
|---|---|---|
| **Ground Robots** | | |
| Eyeball | Remington Tech | 53 |
| ToughBot | Omnitech Robotics | 55 |
| Iris | Toin | 57 |
| LRV | Applied Research Assoc. | 61 |
| VGTV-Extreme | Inuktun | 63 |
| Dragon Runner | Automatika | 65 |
| BomBot | WVHTC | 67 |
| Marv | Mesa Robotics | 71 |
| Neg Tact Surv Robot | Robotic FX | 73 |
| Soryu | IRS | 77 |
| Soryu V | IRS | 79 |
| PackBot EOD | iRobot | 81 |
| PackBot Explorer | iRobot | 83 |
| Hibiscus | Toin | 85 |
| Cphea | Toin | 87 |
| Shinobi | Univer. Electro Comm. | 89 |
| Matilda | Mesa Robotics | 91 |
| ATRV mini | Idaho National Lab | 95 |
| Talon | Foster-Miller | 99 |
| Mini-Andros II | Remotec | 105 |
| Andros F6A | Remotec | 109 |
| Boz I | BOZ Robotics | 113 |
| **Wall Climbers** | | |
| VMRP | Vortex | 117 |
| NanoMag | Inuktun | 119 |
| **Aerial Robots** | | |
| Blimp | ARACAR | 123 |
| AirRobot | AirRobot | 129 |
| Yamaha Heliocoper | Skeyes Unlimited | 141 |





# Event Robots

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# Site Overview

Site Overview

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## Disaster City
## April 4-6, 2006

## Disaster City
## April 4-6, 2006

# Event Introduction

The second in a series of response robot evaluation exercises for DHS/FEMA US&R teams was hosted at the TX-TF1 training facility known as Disaster City located at Texas A&M University, College Station, TX. All applicable robots and supporting technologies (e.g., sensors), purchasable and/or developmental, were invited to take part in this exercise, which highlighted operationally relevant US&R scenarios specifically devised for ground, aerial, and underwater response robots. Based on their experiences deploying robots within the training scenarios, responders selected three robot categories as being the focus deployment types for the development of the Wave 1 standards. These are small throw-able "peek bots;" wide-area ground survey robots; and aerial loiter/survey robots.

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| Talon | Foster-Miller | 99 |
| Mini-Andros II | Remotec | 105 |
| Andros F6A | Remotec | 109 |
| TeleMax | TeleRob | 111 |
| PackBot Scout | iRobot | N/A |
| Sneaky | M-Bots | N/A |
| **Wall Climbers** | | |
| VMRP | Vortex | 117 |
| NanoMag | Inuktun | 119 |
| **Aerial Robots** | | |
| Blimp | ARACAR | 123 |
| Nighthawk | Applied Research Assoc. | 125 |
| Dragon Eye | AeroVironment, Inc. | 131 |
| CyberBug | Cyber Defense Systems, Inc. | 133 |
| Raven | AeroVironment, Inc. | 135 |
| Evolution-XTS | L-3 BAI Aerosystems, Inc | 137 |
| Flying Bassett | Univ. of AL – Huntsville | 139 |
| Wasp | AeroVironment, Inc. | N/A |
| **Aquatic Robots** | | |
| Pro III | VideoRay, LLC | 145 |



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## Site Map

## Site Map

DISASTER CITY
SUAV FLIGHT PERIMETER (2000 FT x 2000 FT)
HAZMAT TRAIN WRECK (#116)
250 FT LAUNCH/RECOVERY
SUAV OPERATOR STATION
SUAV AREA OF INTEREST
PASSENGER TRAIN WRECK (#126)
250 FT LAUNCH/RECOVERY
MAIN STREET
[SHORING, BREACHING, LIFTING]
RUBBLE PILE 1 (#128)
GATE [E]
ICP
NIST
CHECK-IN
LAUNCH
PARKING
TEES
BRIEFS
AERIAL
GROUND
HOUSE OF PANCAKES (#130)
DWELLING (#127)
1ST STREET
THEATER (#129)
STRIP MALL (#135)
PORTO POTTY
LAKE STREET
WOOD PILE (#136)
STEEL STRUCTURE (#134)
RUBBLE PILE 2 (#132)
LAKE RIG
Image © 2006 DigitalGlobe
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| Wall Climbers | 116 |
| Aerial Robots | 122 |
| Aquatic Robots | 144 |
| Sensors | 148 |





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| Sensors | 148 |

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# Safety

Safety

Safety of all personnel participating in this event is our first concern. The fact that we have robotics personnel generally unaccustomed to working within the hazardous environments at these US&R training sites is particularly problematic. Having emergency responders generally unaccustomed to working with robots is also a concern. Please follow these simple guidelines:

• Appropriate personal protective equipment (PPE) must be worn at all times while on site (see associated page on PPE). Compliance with PPE rules are mandatory.

• Rubble piles and other difficult scenarios present the most risk to novices. If your robot needs to be extracted, please ask your associated emergency responder to retrieve it.

• Always maintain awareness of others working within your scenario and communicate your intentions *before* doing whatever you have in mind.

• Robots can do unpredictable things; the bigger/heavier the robot the more space you should allow it when operating. Always verify that the robot is powered off before interacting with it. Never stick your fingers into wheels, tracks, manipulator pinch points, etc. while the robot is powered on. Remotely teleoperated robots may be the most dangerous because the remote operator may not know you decided to perform on-the-spot maintenance! Always familiarize yourself with the EMERGENCY STOP procedures first -- and last -- before interacting with or operating robots. Some implementations are more predictable than others.

• If you see anything you consider unsafe in our environment, please inform the Test Director or any emergency responder on site, and let's discuss it at the daily after action briefing to be sure every potential hazard is addressed.

• **Everybody on site is a safety officer!**



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# Personal Protective Equipment

Personal protective equipment (PPE) is required for working within any US&R scenario at the site. People in street clothes or without helmets/gloves/etc as shown below are limited to paved roads only. If you are working within a scenario, you must wear ALL the equipment shown below. Compliance with these personal protective equipment rules are mandatory - it is standard practice for US&R environments.

- **Helmet**
  Hard hats are okay. We have some to borrow or you can purchase at www.thefirestore.com for $75 and up.
- **Ear protection**
  We'll supply these.
- **Eye protection**
  Sunglasses are okay.
- **Long sleeve shirt**
- **Work gloves**
- **Long pants**
  Army surplus stores sell typical BDU and EMT pants.
- **Boots**
  Preferably steel toe.

Additional protective padding for knees and elbows is optional, but good for rubble piles.



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# Test Methods

# Test Methods

# Cache Packaging, Weight, Setup, Tools

**Requirements (Metric):**

- Logistics: Cache Packaging: Volume (#pelicans: #hardiggs: #ropacks: #pallets)
- Logistics: Cache Packaging: Weight (kilograms)
- Logistics: Cache Packaging: Setup Time (minutes)
- Logistics: Cache Packaging: Transportation Restrictions (yes:no)
- Logistics: Field Maintenance: Spares and Supplies (percent of robot weight)
- Logistics: Field Maintenance: Tools (none:typical:special)
- Human-System Interaction: Portability (kilograms)
- Power: Voltage Compatibility With Cache (yes:no)



# Cache Packaging, Weight, Setup, Tools

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- Logistics: Field Maintenance: Tools (none:typical:special)
- Human-System Interaction: Portability (kilograms)
- Power: Voltage Compatibility With Cache (yes:no)

## Test Method:

- Quantify logistics requirements for system to remain operational for 72 hours without re-supply, and on site for 10 day deployment
- Count qualified containers containing all system components and supplies
- Measure shipping weight and deployed robot weight
- Measure set-up time from unpacking to deployment down-range
- Identify tools required for setup and field maintenance
- Check list or choose appropriate selection from a specifically defined scale for each requirement



Test Methods

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- Count qualified containers containing all system components and supplies
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- Identify tools required for setup and field maintenance
- Check list or choose appropriate selection from a specifically defined scale for each requirement

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# Confined Space

(ZIG-ZAG or FIGURE-8)

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Endurance - Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none:self-righting:invertible continuous operations)




# Confined Space

(ZIG-ZAG or FIGURE-8)

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Endurance - Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none:self-righting:invertible continuous operations)

## Test Method:

- Measure the operator's ability to remotely traverse/negotiate a confined space passage while operating the robot through the operator interface and communications link.
- Random stepfield pallets (full cubic) provide complex flooring and ceiling obstacles.
- Adjustable posts heights provide diminishing void space for increased difficulty.
- Test in ambient light and dark environments, radio and tether communications separately.



Test Methods

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- Adjustable posts heights provide diminishing void space for increased difficulty.
- Test in ambient light and dark environments, radio and tether communications separately.

22

# Directed Perception

**Requirements (Metric):**

- Payload: Manipulation: Sensor Manipulation (yes:no, holes/level)
- Payload: Manipulation: Max Reach (centimeters , holes/level)
- Chassis: Illumination: Variable (yes:no)
- Sensing: Real-time Color Video: Near Field Acuity (smallest chart line)
- Sensing: Remote Temperature (yes:no)
- Sensing: Audio: Two-way (volume control:listen always-push to talk:stereo:direction indicator)
- Sensing: Hazmat Detection (PH+$O_2$,LEL,CO, $H_2S$,RAD : plus WMD and TIC detection/classification : plus Tentative WMD and TIC identification : plus WMD and TIC sampling)
- Human-System Interaction: Initial Training (hours)
- Human-System Interaction: Proficiency Education (hours/year)
- Human-System Interaction: Acceptable Usability (effectiveness, percent of targets)
- Human-System Interaction: Assistive: Auto Notification (yes:no)
- Human-System Interaction: Assistive: Path Tracing (yes:no)



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- Human-System Interaction: Acceptable Usability (effectiveness, percent of targets)
- Human-System Interaction: Assistive: Auto Notification (yes:no)
- Human-System Interaction: Assistive: Path Tracing (yes:no)

## Test Method:

- Measure the operator's ability to remotely position sensors near holes in box stacks to identify assorted targets placed inside while operating the robot through the operator interface and communications link.
- Box stacks surround the robot on thee sides (front, left, right) with holes on facing and top surfaces. Each level is tested sequentially up to four levels high (72 inch / 180 cm). Holes are offset from the centerline robot position.
- Visual targets inside the holes require positioning a camera with adjustable illumination into two different horizontal viewing angles at each level to read visual acuity charts (0° directly through the hole) and hazmat labels (approximately 25° inward toward the centerline).
- Other targets/sensors can be used including chemical, radiological, explosive, thermal, etc. which also allow first detection measurements.
- Various terrain pallets to increase difficulty include flat floor, pitch ramp, roll ramp, and random stepfields.
- Test in ambient light and dark environments, radio and tether communications separately.



Test Methods

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- Various terrain pallets to increase difficulty include flat floor, pitch ramp, roll ramp, and random stepfields.
- Test in ambient light and dark environments, radio and tether communications separately.

# Grasping Dexterity

**Requirements (Metric):**

- Payload: Manipulation: Sensor Manipulation (yes:no, blocks/level)
- Payload: Manipulation: Max Reach (centimeters, blocks/level)
- Payload: Delivery (kilograms at max reach, blocks/level)
- Payload: Retrieval (centimeters at max reach, blocks/level)
- Payload: Emplacement (yes:no, blocks/level)



Grasping Dexterity

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- Payload: Delivery (kilograms at max reach, blocks/level)
- Payload: Retrieval (centimeters at max reach, blocks/level)
- Payload: Emplacement (yes:no, blocks/level)

## Test Method:

- Measure the operator's ability to remotely grasp and place blocks onto shelf stacks with three different access approaches while operating the robot through the operator interface and communications link.
- Shelf stacks surround the robot on thee sides (front, left, right) with nine objects placed in designated quadrants of one given surface. All surfaces have nine quadrants clearly marked.
- Objects placed on any given test level must be grasped and placed onto the remaining stacks at that level, requiring three different access approaches (open, under, over). Each object should be placed in the correlating quadrant of each stack. Each level is tested sequentially up to four levels high (72 in / 180 cm).
- Other objects can be used including simulated pipe bombs, water bottles with shock tube, communications devices, emplaced sensors, etc..
- Various terrain pallets including flat flooring, pitch ramp, roll ramp, and random stepfields increase difficulty.
- Test in ambient light and dark environments, radio and tether communications separately.



Test Methods

## Test Method:

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- Various terrain pallets including flat flooring, pitch ramp, roll ramp, and random stepfields increase difficulty.
- Test in ambient light and dark environments, radio and tether communications separately.

# Human Systems Interactions

**Requirements (Metric):**

- Human-System Interaction: Operator Ratio (operators/robot)
- Human-System Interaction: Context: Protective Clothing (yes:no)
- Human-System Interaction: Context: Lighting Conditions (dark:daylight:glare)
- Human-System Interaction: Context: Mobility (stationary:portable:mobile)
- Human-System Interaction: Context: Operator Disengagement (yes:no)
- Human-System Interaction: Context: Co-Located Information Sharing (yes:no)
- Human-System Interaction: Context: Remote Information Sharing (meters)
- Human-System Interaction: Display: Dashboard (yes:no)
- Human-System Interaction: Display: Mission Data Integration (yes:no)
- Human-System Interaction: Interaction: Component Controls (yes:no, diagnostics)
- Human-System Interaction: Interaction: Adjustable Noise Filtering (yes:no)



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- Human-System Interaction: Display: Mission Data Integration (yes:no)
- Human-System Interaction: Interaction: Component Controls (yes:no, diagnostics)
- Human-System Interaction: Interaction: Adjustable Noise Filtering (yes:no)

## Requirements (Metric) Continued:

- Human-System Interaction: Assistive: Unattended Sampling (yes:no)
- Human-System Interaction: Assistive: Auto Notification (yes:no)
- Human-System Interaction: Assistive: Path Tracing (yes:no)
- Human-System Interaction: Assistive: Re-acquire Communications (yes:no)
- Human-System Interaction: Assistive: Station Keeping (# of axes)
- Human-System Interaction: Assistive: Self Extraction
- (yes:no)
- Human-System Interaction: Assistive: Emergency Stop (yes:no)
- Sensing: Real-time Color Video: Pan/Tilt Orientation Indicator (yes:no)

## Test Method:

- Identify assorted operational features demonstrated during setup, practice, and/or testing.
- Check list or choose appropriate selection from a specifically defined scale for each requirement.



Test Methods

Requirements (Metric) Continued:

- Human-System Interaction: Assistive: Unattended Sampling (yes:no)
- Human-System Interaction: Assistive: Auto Notification (yes:no)
- Human-System Interaction: Assistive: Path Tracing (yes:no)
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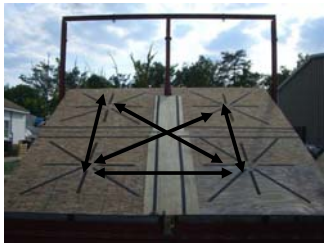
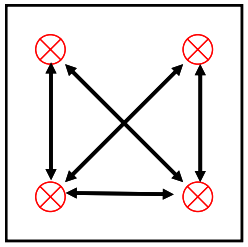
# Inclined Plane

(WALL CLIMBING and INVERTED OPERATIONS)





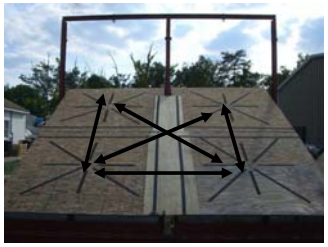
**Requirements (Metric):**

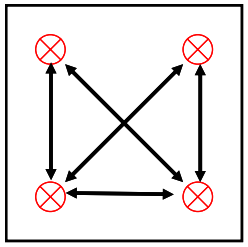
- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Sustained Speed - Soft (kilometers/hour)
- Mobility: Locomotion: Sustained Speed - Firm (kilometers/hour)
- Mobility: Tumble Recovery Within Terrain Type (none: self-righting: invertible continuous operations)



# Inclined Plane

(WALL CLIMBING and INVERTED OPERATIONS)





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- Mobility: Locomotion: Sustained Speed - Firm (kilometers/hour)
- Mobility: Tumble Recovery Within Terrain Type (none: self-righting: invertible continuous operations)

## Test Method:

- Measure the operator's ability to remotely traverse an inclined/vertical/inverted plane while operating the robot through the operator interface and communications link.
- A pattern of goal positions on the plane provide prescribed straight line paths to traverse including directly ascending, directly descending, diagonal and cross incline paths.
- The incline can be adjusted from 20° - 80° for ground robots, 90° for wall climbing robots, or 100° to 180° for robots capable of inverted operations.
- The incline can be covered in a variety of surfaces (including random stepfields), but is initially simple oriented strand board (OSB)
- Test in ambient light and dark environments, radio and tether communications separately



Test Methods

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# Mobility/Endurance

(ZIG-ZAG or FIGURE 8)

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Sustained Speed - Soft (kilometers/hour)
- Mobility: Locomotion: Sustained Speed - Firm (kilometers/hour)
- Mobility: Locomotion: Endurance - Obstacles (hours)
- Mobility: Locomotion: Endurance - Soft (hours)
- Mobility: Locomotion: Endurance - Firm (hours)
- Mobility: Tumble Recovery Within Terrain Type (none:self-righting:invertible continuous operations)
- Power: Working Time (single charge)
- (1 hour: 4 hours: 12 hours)
- Logistics: Field Maintenance: Intervals (12hours:24hours:72hours:10days)
- Logistics: Field Maintenance: Duration (minutes)
- Logistics: Shock Resistance: (drop test, vibration test)
- Logistics: Mean Time Before Failure (hours)




# Mobility/Endurance

(ZIG-ZAG or FIGURE 8)

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- Mobility: Locomotion: Sustained Speed - Soft (kilometers/hour)
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- Logistics: Field Maintenance: Duration (minutes)
- Logistics: Shock Resistance: (drop test, vibration test)
- Logistics: Mean Time Before Failure (hours)

## Test Method:

- Measure the operator's ability to remotely traverse/negotiate various terrain types within a fixed course to show mobility or endurance while operating the robot through the operator interface and communications link.
- Walls define the courses in the "Mobility/Endurance" test methods.
- Various repeatable terrain pallets can be used including flat floors, pitch ramps, roll ramps, and random stepfields to increase difficulty. Other terrains can be used including gravel, tarmac, snow, etc.
- Endurance testing can include logistics requirements for failures and repairs.
- Test in ambient light and dark environments, radio and tether communications separately.



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- Test in ambient light and dark environments, radio and tether communications separately.

# Other Operational Features

**Requirements (Metric):**

- Chassis: Tether Point
  (yes:no)
- Chassis: System Component Interoperability
  (yes:no)
- Power: Run Time Indicator
  (yes:no)
- Power: Dwell Time
  (12 hours: 24 hours: 72 hours: 10 days)
- Sensing: Internal: Orientation Reporting
  (# of axis)
- Sensing: Structural: Void Detection
  (yes:no)
- Sensing: Structural: Range Finder
  (yes:no)
- Sensing: Victim Indicators: Thermal Imaging
  (industry:military:US&R needs such as leaks, fire, etc)
- Sensing: Victim Indicators: Seismic
  (yes:no)



# Other Operational Features

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- Sensing: Victim Indicators: Seismic
  (yes:no)

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## Requirements (Metric) Continued:

- Passive Data Logging Offboard: System Health (yes:no)
- Passive Data Logging Offboard: Location (yes:no)
- Passive Data Logging Offboard: Hazmat (yes:no)
- Passive Data Logging Offboard: Victim Indicators (yes:no)
- Passive Data Logging Offboard: Video (yes:no)
- Passive Data Logging Onboard: System Health (yes:no)
- Passive Data Logging Onboard: Location (yes:no)
- Passive Data Logging Onboard: Hazmat (yes:no)
- Passive Data Logging Onboard: Victim Indicators (yes:no)
- Passive Data Logging Onboard: Video (yes:no)

## Test Method:

- Identify assorted operational features demonstrated during setup, practice, and/or testing.
- Check list or choose appropriate selection from a specifically defined scale for each requirement.



Test Methods

## Requirements (Metric) Continued:

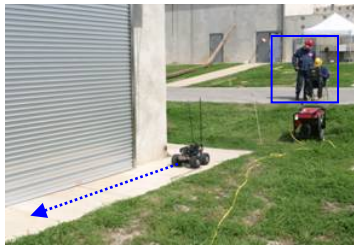
- Passive Data Logging Offboard: System Health (yes:no)
- Passive Data Logging Offboard: Location (yes:no)
- Passive Data Logging Offboard: Hazmat (yes:no)
- Passive Data Logging Offboard: Victim Indicators (yes:no)
- Passive Data Logging Offboard: Video (yes:no)
- Passive Data Logging Onboard: System Health (yes:no)
- Passive Data Logging Onboard: Location (yes:no)
- Passive Data Logging Onboard: Hazmat (yes:no)
- Passive Data Logging Onboard: Victim Indicators (yes:no)
- Passive Data Logging Onboard: Video (yes:no)

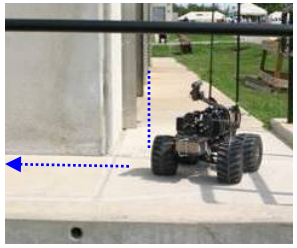
## Test Method:

- Identify assorted operational features demonstrated during setup, practice, and/or testing.
- Check list or choose appropriate selection from a specifically defined scale for each requirement.

# Radio Communications

(LINE OF SIGHT, BEYOND LINE OF SIGHT)





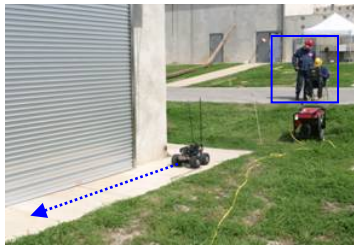
**Requirements (Metric):**

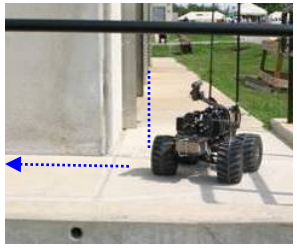
- Communications: Range: Line of Sight (meters)
- Communications: Range: Beyond Line of Sight (meters)
- Communications: Security (shielded from jamming and interference in none:commands:data and commands)
- Communications: Data Logging: Status and Notes (yes:no)




# Radio Communications

(LINE OF SIGHT, BEYOND LINE OF SIGHT)




**Requirements (Metric):**

- Communications: Range: Line of Sight (meters)
- Communications: Range: Beyond Line of Sight (meters)
- Communications: Security (shielded from jamming and interference in none:commands:data and commands)
- Communications: Data Logging: Status and Notes (yes:no)

## Test Method:

- Measure the operator's ability to remotely control the robot down-range while operating the robot through the operator interface and radio communications link.
- Line of Sight: Read visual acuity and hazmat label targets straight down-range to demonstrate control and data communications channels are functional.
- Beyond Line of Sight: At the end of the line of sight test, turn 90° around the corner of an appropriately large building. Maintain the robot within 1.2 meters along the building's wall and read near field visual acuity charts and hazmat labels at equally spaced intervals from the corner until command or data communications fail.



Test Methods

## Test Method:

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# Random Maze

**Requirements (Metric):**

- Human-System Interaction: Initial Training (hours)
- Human-System Interaction: Proficiency Education (hours/year)
- Human-System Interaction: Acceptable Usability (effectiveness, percent of targets)
- Human-System Interaction: Assistive: Path Tracing (yes:no)
- Sensing: Location: Absolute (topological from start : plus mapping onto floor plans : plus 3D GIS map)
- Sensing: Location: Relative Accuracy (meters)
- Sensing: Location: Absolute Accuracy (meters)
- Sensing: Mapping: Spatial Modeling (yes:no)
- Sensing: Mapping: Waypoint Annotation (manual : manual and automatic : fully automatic and integrated)
- Sensing: Mapping: Operator Annotations (yes:no)
- Sensing: Mapping: Equipment Setup Time (minutes)



# Random Maze

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- Sensing: Mapping: Waypoint Annotation (manual : manual and automatic : fully automatic and integrated)
- Sensing: Mapping: Operator Annotations (yes:no)
- Sensing: Mapping: Equipment Setup Time (minutes)

## Test Method:

- Measure the operator's ability to remotely traverse/negotiate a random maze of hallways and rooms while operating the robot through the operator interface and communications link.
- Walls define the random maze of 1.2 meter wide hallways.
- Various repeatable terrain pallets can be used including flat floors, pitch ramps, roll ramps, and random stepfields to increase difficulty. Other terrains can be used including gravel, tarmac, snow, etc.
- Mission goals can be to simply find a path end to end, find a path end to end with target identifications along the way, right hand wall following techniques, completeness of search space, etc.
- Test in ambient light and dark environments, radio and tether communications separately.



Test Methods

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- Test in ambient light and dark environments, radio and tether communications separately.

# Stairs

(ASCENDING AND DESCENDING)

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Endurance - Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none:self-righting:invertible continuous operations)




# Stairs

(ASCENDING AND DESCENDING)

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed - Obstacles (kilometers/hour)
- Mobility: Locomotion: Endurance - Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none:self-righting:invertible continuous operations)

## Test Method:

- Measure the operator’s ability to remotely control the robot to ascend and descent stairs while operating the robot through the operator interface and radio communications link.

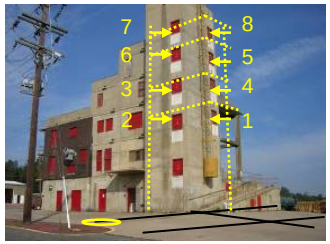


Test Methods

Test Method:

- Measure the operator’s ability to remotely control the robot to ascend and descent stairs while operating the robot through the operator interface and radio communications link.

# Station Keeping (Aerial)

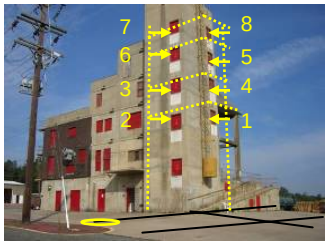


**Requirements (Metric):**

- Mobility: Aerial: Station Keeping
  (# of axis)
- Mobility: Aerial: Area of Coverage
  (square kilometers/hour)
- Human-System Interaction: Initial Training
  (hours)
- Human-System Interaction: Proficiency Education
  (hours/year)
- Human-System Interaction: Acceptable Usability
  (effectiveness, percent of targets)
- Human-System Interaction: Assistive: Auto Notification
  (yes:no)
- Human-System Interaction: Assistive: Path Tracing
  (yes:no)



# Station Keeping (Aerial)



**Requirements (Metric):**

- Mobility: Aerial: Station Keeping
  (# of axis)
- Mobility: Aerial: Area of Coverage
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- Human-System Interaction: Initial Training
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- Human-System Interaction: Acceptable Usability
  (effectiveness, percent of targets)
- Human-System Interaction: Assistive: Auto Notification
  (yes:no)
- Human-System Interaction: Assistive: Path Tracing
  (yes:no)

## Test Method:

- Measure the operator's ability to remotely control the robot to look in each window of a building while operating the robot through the operator interface and radio communications link.
- Visual acuity charts and hazmat labels are positioned inside the windows, some flush mounted and others recessed inside, to give the operator some tasks to perform.
- Prescribed paths from window to window are performed without direct line of sight from the operator to the robot.
- Test in ambient light and dark environments, radio and tether (if available) communications separately.



Test Methods

Test Method:

- Measure the operator's ability to remotely control the robot to look in each window of a building while operating the robot through the operator interface and radio communications link.
- Visual acuity charts and hazmat labels are positioned inside the windows, some flush mounted and others recessed inside, to give the operator some tasks to perform.
- Prescribed paths from window to window are performed without direct line of sight from the operator to the robot.
- Test in ambient light and dark environments, radio and tether (if available) communications separately.

# Step/Gap

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed – Obstacles (km/hr)
- Mobility: Locomotion: Endurance – Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none: self-righting: invertible continuous operations)



# Step/Gap

**Requirements (Metric):**

- Mobility: Locomotion: Sustained Speed – Obstacles (km/hr)
- Mobility: Locomotion: Endurance – Obstacles (hours)
- Mobility: Tumble Recovery Within Terrain Type (none: self-righting: invertible continuous operations)

## Test Method:

- Measure the operator's ability to remotely control the robot to traverse gaps of incremental lengths between pallets, ascend and descend incremental stacks of pallets both with square edges and with pipe diameters equal to the pallet step heights, while operating the robot through the operator interface and communications link (tested separately if radio and tether are available).



Test Methods

Test Method:

- Measure the operator's ability to remotely control the robot to traverse gaps of incremental lengths between pallets, ascend and descend incremental stacks of pallets both with square edges and with pipe diameters equal to the pallet step heights, while operating the robot through the operator interface and communications link (tested separately if radio and tether are available).

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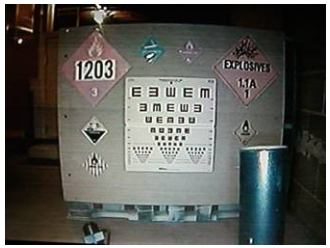
# Visual Acuity

(WITH VARIABLE ILLUMINATION)



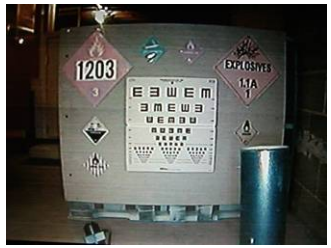

**Requirements (Metric):**

- Sensing: Real-time Color Video: Far Field Acuity (smallest chart line)
- Sensing: Real-time Color Video: Near Field Acuity (smallest chart line)
- Sensing: Real-time Color Video: Field of View (degrees)
- Sensing: Real-time Color Video: Pan (degrees)
- Sensing: Real-time Color Video: Tilt (degrees)
- Sensing: Real-time Color Video: Pan/Tilt Rate (degrees/second)
- Sensing: Real-time Color Video: Pan/Tilt Orientation Indicator (yes:no)
- Chassis: Illumination: Adjustable (yes:no)



# Visual Acuity

(WITH VARIABLE ILLUMINATION)




**Requirements (Metric):**

- Sensing: Real-time Color Video: Far Field Acuity (smallest chart line)
- Sensing: Real-time Color Video: Near Field Acuity (smallest chart line)
- Sensing: Real-time Color Video: Field of View (degrees)
- Sensing: Real-time Color Video: Pan (degrees)
- Sensing: Real-time Color Video: Tilt (degrees)
- Sensing: Real-time Color Video: Pan/Tilt Rate (degrees/second)
- Sensing: Real-time Color Video: Pan/Tilt Orientation Indicator (yes:no)
- Chassis: Illumination: Adjustable (yes:no)

## Test Method:

- Measure the operator's ability to remotely read standard visual acuity charts, both near field and far field, while operating the robot through the operator interface and communications link.
- Measure each camera's field of view, pan, tilt, and associated rates.
- Identify functionality of pan/tilt indicator on operator interface.
- Test in ambient light and dark environments, radio and tether communications separately.



Test Methods

## Test Method:

- Measure the operator's ability to remotely read standard visual acuity charts, both near field and far field, while operating the robot through the operator interface and communications link.
- Measure each camera's field of view, pan, tilt, and associated rates.
- Identify functionality of pan/tilt indicator on operator interface.
- Test in ambient light and dark environments, radio and tether communications separately.

# Props:
# Repeatable Terrain

**Random Stepfield Pallets:**

- Levels of difficulty:
  - Half-cubic stepfield pallets (orange) provide repeatable surface topologies for orientation complexity in static tests such as “Directed Perception” or “Grasping Dexterity.”
  - Full-cubic stepfield pallets (red) provide repeatable surface topologies for test methods such as “Confined Space” and “Mobility/Endurance.”
- Scaleable sizes:
  - Small-size robots use pallets made of 2x2 posts (5 cm x 5 cm)
  - Mid-size robots use pallets made of 4x4 posts (10 cm x 10 cm) (shown)
  - Large-size robots use pallets made of clusters of (4) 4x4 posts (10 cm x 10 cm)
- Assorted topologies:
  - Random flat pallets
  - Random hill pallets
  - Random diagonal hill pallets




# Props:
# Repeatable Terrain

**Random Stepfield Pallets:**

- Levels of difficulty:
  - Half-cubic stepfield pallets (orange) provide repeatable surface topologies for orientation complexity in static tests such as “Directed Perception” or “Grasping Dexterity.”
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- Scaleable sizes:
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  - Large-size robots use pallets made of clusters of (4) 4x4 posts (10 cm x 10 cm)
- Assorted topologies:
  - Random flat pallets
  - Random hill pallets
  - Random diagonal hill pallets

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Test Methods

## Pitch/roll Ramps:

- 5°, 10°, and 15° pitch and roll ramps provide non-flat flooring for orientation complexity within test methods such as “Directed Perception,” “Grasping Dexterity,” “Random Maze,” or “Mobility/Endurance.”

Test Methods

## Pitch/roll Ramps:

- 5°, 10°, and 15° pitch and roll ramps provide non-flat flooring for orientation complexity within test methods such as “Directed Perception,” “Grasping Dexterity,” “Random Maze,” or “Mobility/Endurance.”

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# Props:
# Targets And Objects

### Visual Acuity Charts:

- Far-field and near-field charts provide easy to recognize “tumbling E’s” with standard metrics to measure an operator’s ability to discern details in the video image when viewed remotely through the operator interface and communications link. These charts are used in test methods such as “Directed Perception,” “Radio Communications,” “Random Maze,” “Station Keeping,” and “Visual Acuity.”

### Hazmat Labels:

- Various hazmat labels provide operationally significant targets in the environment to identify colors, shapes, icons, numbers and letters, which relate directly back to the visual acuity charts. Hazmat labels are used in test methods such as “Directed Perception,” “Radio Communications,” “Random Maze,” “Station Keeping,” and “Visual Acuity.”



Props:
Targets And Objects

### Visual Acuity Charts:

- Far-field and near-field charts provide easy to recognize “tumbling E’s” with standard metrics to measure an operator’s ability to discern details in the video image when viewed remotely through the operator interface and communications link. These charts are used in test methods such as “Directed Perception,” “Radio Communications,” “Random Maze,” “Station Keeping,” and “Visual Acuity.”

### Hazmat Labels:

- Various hazmat labels provide operationally significant targets in the environment to identify colors, shapes, icons, numbers and letters, which relate directly back to the visual acuity charts. Hazmat labels are used in test methods such as “Directed Perception,” “Radio Communications,” “Random Maze,” “Station Keeping,” and “Visual Acuity.”

Test Methods

## Wood Blocks:

- Simple wood blocks of two different lengths (one short enough to grasp from any direction, one long enough to require a vertical grasp for most grippers) are used in the “Grasping Dexterity” test method to provide abstract but repeatable grasping tasks that emphasize manipulator dexterity.

## Others:

- Simulated pipe bombs and mineral water bottles with shock tube detonators provide operationally recognizable shapes and weights for use in test methods such as “Directed Perception” or “Grasping Dexterity” or “Random Maze.”
- Thermal heating pads and trace sources of chemical, radiological, and explosive samples are also used in test methods such as“Directed Perception” and the “Random Maze.”

Test Methods

## Wood Blocks:

- Simple wood blocks of two different lengths (one short enough to grasp from any direction, one long enough to require a vertical grasp for most grippers) are used in the “Grasping Dexterity” test method to provide abstract but repeatable grasping tasks that emphasize manipulator dexterity.

## Others:

- Simulated pipe bombs and mineral water bottles with shock tube detonators provide operationally recognizable shapes and weights for use in test methods such as “Directed Perception” or “Grasping Dexterity” or “Random Maze.”
- Thermal heating pads and trace sources of chemical, radiological, and explosive samples are also used in test methods such as“Directed Perception” and the “Random Maze.”

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# Ground Robots

# Ground Robots

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# EyeBall R1

Remington Tech. Div.
www.remingtonTD.com
301-208-8686/Pat Moore

**Manufacturer's Specs:**

- Circumference 3.25" (8.25 cm)
- Weight: 1.25 lbs (.566kg)
- Turning Diam: 0"
- Max Speed: rotates 4 RPM
- Power Source: battery
- Endurance: 3 hours
- Tether: none
- Control: eyes-on, remote teleop
- Sensors: camera
- Payload: N/A
- Manipulator: N/A

| | |
|---|---|
| Radio Tx: | 2400 MHz, 902-928MHz (RF) |
| Radio Rx: | 2400 MHz, 902-928MHz (RF) |



# EyeBall R1

Remington Tech. Div.
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| | |
|---|---|
| Radio Tx: | 2400 MHz, 902-928MHz (RF) |
| Radio Rx: | 2400 MHz, 902-928MHz (RF) |

# EyeBall R1

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# EyeBall R1

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

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Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# ToughBot

Omnitech Robotics International LLC
www.omnitech.com
303-922-7773/Dave Parish

**Manufacturer's Specs:**

- Width: 3.14" (8 cm)
- Length: 4.3" (11 cm)
- Height: 4.3" (11 cm)
- Weight: 2 lb (.9 kg)
- Turning Diam: 0"
- Max Speed: TBD
- Power Source: battery
- Endurance: 1 hour
- Tether: none
- Control: eyes-on, remote teleop
- Sensors: 2 camera (wide and narrow)
- Payload: N/A
- Manipulator: N/A

| | |
|---|---|
| Radio Tx: | 2400 MHz, 868MHz |
| Radio Rx: | 2400 MHz, 868MHz |




# ToughBot

Omnitech Robotics International LLC
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303-922-7773/Dave Parish

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| | |
|---|---|
| Radio Tx: | 2400 MHz, 868MHz |
| Radio Rx: | 2400 MHz, 868MHz |

# ToughBot

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# ToughBot

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

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LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

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Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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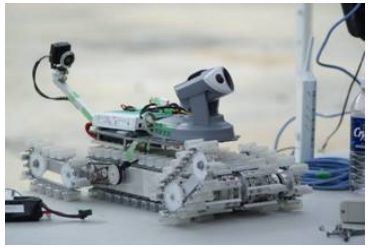
# Iris

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org



**Manufacturer's Specs:**

- Width:
- Length:
- Height:
- Weight:
- Turning Dia:
- Max Speed:
- Power Source:
- Endurance:
- Tether:
- Control:
- Sensors:
- Payload:
- Manipulator:

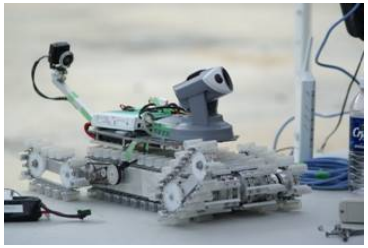
## Specifications Unavailable

Radio TX:
Radio RX:



# Iris

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org



**Manufacturer's Specs:**

- Width:
- Length:
- Height:
- Weight:
- Turning Dia:
- Max Speed:
- Power Source:
- Endurance:
- Tether:
- Control:
- Sensors:
- Payload:
- Manipulator:

## Specifications Unavailable

Radio TX:
Radio RX:

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# Iris

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Iris

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Active Scope Camera

Tohoku University, Tadokoro Laboratory
www.rm.is.tohoku.ac.jp

**Manufacturer's Specs:**

- Width: 1" (2.5cm)
- Length: 320" (80 cm)
- Height: 1" (2.5 cm)
- Weight: 10 lbs (5 kg)
- Turning Dia: 4" – 80" (10cm – 200 cm)
- Max Speed: .2 fps (6 cmps)
- Power Source: battery
- Endurance: 60 min
- Tether: body is the tether
- Control: teleop
- Sensors: CCD camera
- Payload: N/A
- Manipulator: N/A

Radio TX: Tethered
Radio RX:



# Active Scope Camera

Tohoku University, Tadokoro Laboratory
www.rm.is.tohoku.ac.jp

**Manufacturer's Specs:**

- Width: 1" (2.5cm)
- Length: 320" (80 cm)
- Height: 1" (2.5 cm)
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- Max Speed: .2 fps (6 cmps)
- Power Source: battery
- Endurance: 60 min
- Tether: body is the tether
- Control: teleop
- Sensors: CCD camera
- Payload: N/A
- Manipulator: N/A

Radio TX: Tethered
Radio RX:

# Active Scope Camera

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Active Scope Camera

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# LRV

Applied Research Associates
www.ARA.com
303-795-8106/Andrew Poulter

**Manufacturer's Specs:**

- Width: 20" (51 cm)
- Length: 14" (36 cm)
- Height: 6.5" (16 cm)
- Weight: 14 lbs (6.3 kg)
- Turning Diam: 20" (51 cm)
- Max Speed: 6 fps (1.8 mps)
- Power Source: 8.5 AH Lithium Polymer
- Endurance: 60-240 min
- Tether: Option
- Control: Remote tele-operation
- Sensors: Color / IR Cameras
- Payload: 1.2 lb(0.5 kg) , drag 20 lb (9 kg)
- Manipulator: N/A –future option, existing boom reach is 18 in (45 cm

Radio Tx: 75MHz(75mW), 900 MHz(100mW),2400MHz(200mW)
Radio Rx: 75 MHz , 900 MHz , 2400 MHz



# LRV

Applied Research Associates
www.ARA.com
303-795-8106/Andrew Poulter

**Manufacturer's Specs:**

- Width: 20" (51 cm)
- Length: 14" (36 cm)
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- Weight: 14 lbs (6.3 kg)
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- Max Speed: 6 fps (1.8 mps)
- Power Source: 8.5 AH Lithium Polymer
- Endurance: 60-240 min
- Tether: Option
- Control: Remote tele-operation
- Sensors: Color / IR Cameras
- Payload: 1.2 lb(0.5 kg) , drag 20 lb (9 kg)
- Manipulator: N/A –future option, existing boom reach is 18 in (45 cm

Radio Tx: 75MHz(75mW), 900 MHz(100mW),2400MHz(200mW)
Radio Rx: 75 MHz , 900 MHz , 2400 MHz

# LRV

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# LRV

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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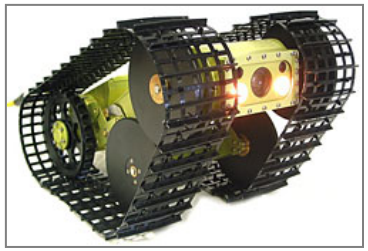
# VGTV-Extreme

Inuktun
www.inuktun.com/
1-877-468-5886/ Derek Naughton



**Manufacturer's Specs:**

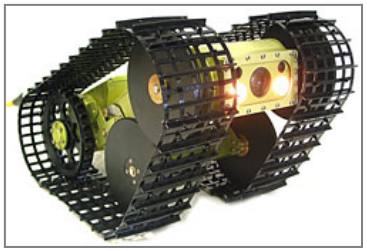
- Width: 10.9" (27.7 cm)
- Length: 16.8" (42.7 cm)
- Height: 5.5" (14 cm) Lowered
- Weight: 14-20lbs( 6.2-9.1kg )
- Turning Diam: 0" (0 cm)
- Max Speed: 1.5 fps (.45 mps)
- Power Source: lithium ion battery
- Endurance: >360 min
- Tether: power, comms
- Control: eyes-on, remote teleop
- Sensors: tilt camera 300º
- Payload: 10 lb (4.5 kg)
- Manipulator: N/A

Radio Tx: (tether only)
Radio Rx: (tether only)




# VGTV-Extreme

Inuktun
www.inuktun.com/
1-877-468-5886/ Derek Naughton

**Manufacturer's Specs:**

- Width: 10.9" (27.7 cm)
- Length: 16.8" (42.7 cm)
- Height: 5.5" (14 cm) Lowered
- Weight: 14-20lbs( 6.2-9.1kg )
- Turning Diam: 0" (0 cm)
- Max Speed: 1.5 fps (.45 mps)
- Power Source: lithium ion battery
- Endurance: >360 min
- Tether: power, comms
- Control: eyes-on, remote teleop
- Sensors: tilt camera 300º
- Payload: 10 lb (4.5 kg)
- Manipulator: N/A

Radio Tx: (tether only)
Radio Rx: (tether only)

# VGTV-Extreme

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# VGTV-Extreme

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Dragon Runner

Automatika, Inc.
www.automatika.com
412-968-1022 /William Crowley

**Manufacturer's Specs:**

- Width: 12.2" (31 cm)
- Length: 16.6" (42 cm)
- Height: 6" (15.2 cm)
- Weight: 14 lbs (6.4 kg)
- Turning Diam: Zero-Turn; Swept
- Max Speed: 7.5 - 29 fps (5 - 20 mph)
- Power Source: battery (NimH baseline)
- Endurance: 45 min @ 13 mph on flat ground
- Tether: none
- Control: remote teleop, loss-of-comms back-tracking, cruise-control
- Sensors: thermal (PIR), acoustic, visual (wide-angle FF lens; IR illuminator)
- Payload: 10 lb (4.5 kg)
- Manipulator: TBD

Radio Tx: Low S-Band MHz(1 – 1k mW)L-Band MHz (1–1K mW)
Radio Rx: n/a



# Dragon Runner

Automatika, Inc.
www.automatika.com
412-968-1022 /William Crowley

**Manufacturer's Specs:**

- Width: 12.2" (31 cm)
- Length: 16.6" (42 cm)
- Height: 6" (15.2 cm)
- Weight: 14 lbs (6.4 kg)
- Turning Diam: Zero-Turn; Swept
- Max Speed: 7.5 - 29 fps (5 - 20 mph)
- Power Source: battery (NimH baseline)
- Endurance: 45 min @ 13 mph on flat ground
- Tether: none
- Control: remote teleop, loss-of-comms back-tracking, cruise-control
- Sensors: thermal (PIR), acoustic, visual (wide-angle FF lens; IR illuminator)
- Payload: 10 lb (4.5 kg)
- Manipulator: TBD

Radio Tx: Low S-Band MHz(1 – 1k mW)L-Band MHz (1–1K mW)
Radio Rx: n/a

# Dragon Runner

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Dragon Runner

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# BomBot

WVHTC Foundation
www.wvhtf.org
304-368-4518/Carey Bulter

**Manufacturer's Specs:**

- Width: 18" (45.72 cm)
- Length: 20" (50.8 cm)
- Height: 32" (81.28 cm)
- Weight: 15 lbs (6.8kg)
- Turning Diam: 2ft. (60.96 cm)
- Max Speed: 20 mph (32 km/hr)
- Power Source: battery
- Endurance: 3-4 hrs.
- Tether: none
- Control: eyes-on, remote teleop
- Sensors: none
- Payload: 10 lbs (4.5kg)
- Manipulator: N/A

Radio Tx: 2400 MHz
Radio Rx: 2400 MHz



# BomBot

WVHTC Foundation
www.wvhtf.org
304-368-4518/Carey Bulter

**Manufacturer's Specs:**

- Width: 18" (45.72 cm)
- Length: 20" (50.8 cm)
- Height: 32" (81.28 cm)
- Weight: 15 lbs (6.8kg)
- Turning Diam: 2ft. (60.96 cm)
- Max Speed: 20 mph (32 km/hr)
- Power Source: battery
- Endurance: 3-4 hrs.
- Tether: none
- Control: eyes-on, remote teleop
- Sensors: none
- Payload: 10 lbs (4.5kg)
- Manipulator: N/A

Radio Tx: 2400 MHz
Radio Rx: 2400 MHz

# BomBot

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# BomBot

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# BomBot 2

WVHTC Foundation
www.wvhtf.org
304-368-4518/Carey Bulter

**Manufacturer's Specs:**

- Width: 19.5" (49.5 cm)
- Length: 22.8" (57.8 cm)
- Height: 10"- 23" (25.4 -58.4 cm)
- Weight: 30 lbs (13.6 kg)
- Turning Diam: 110 in (280 cm)
- Max Speed: 14.6 fps (4.5 mps)
- Power Source: 24VDC BB2590 or BB390 battery (2 vehicle, 1 OCU); 1.5V AA (4 in OCU)
- Endurance: 180 mins
- Tether: none
- Control: Remote teleoperation, line-of-sight
- Sensors: (modular Wide-angle surveillance camera mission plate to adapt sensors)
- Payload: lbs 45 lbs (20.4 kg) on mission plate, 60 (27.2 kg) towed (optional wagon)
- Manipulator: N/A

Radio TX: 2390 MHz (CH6) /1000 mW (video), 2440 to 2480 MHz /100 mW (commands)




# BomBot 2

WVHTC Foundation
www.wvhtf.org
304-368-4518/Carey Bulter

**Manufacturer's Specs:**

- Width: 19.5" (49.5 cm)
- Length: 22.8" (57.8 cm)
- Height: 10"- 23" (25.4 -58.4 cm)
- Weight: 30 lbs (13.6 kg)
- Turning Diam: 110 in (280 cm)
- Max Speed: 14.6 fps (4.5 mps)
- Power Source: 24VDC BB2590 or BB390 battery (2 vehicle, 1 OCU); 1.5V AA (4 in OCU)
- Endurance: 180 mins
- Tether: none
- Control: Remote teleoperation, line-of-sight
- Sensors: (modular Wide-angle surveillance camera mission plate to adapt sensors)
- Payload: lbs 45 lbs (20.4 kg) on mission plate, 60 (27.2 kg) towed (optional wagon)
- Manipulator: N/A

Radio TX: 2390 MHz (CH6) /1000 mW (video), 2440 to 2480 MHz /100 mW (commands)

# BomBot 2

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# BomBot 2

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Marv

Mesa Robotics, Inc.
www.mesa-robotics.com
256-464-7252/Mike Cole

**Manufacturer's Specs:**

- Width: 13.5" (34.29 cm)
- Length: 20.5" (52.07 cm)
- Height: 12" (30.48 cm)
- Weight: 25 lbs (11.33 kg)
- Turning Dia: zero in
- Max Speed: 4 mph (6.4 km/hr)
- Power Source: 12VDC, NiMH battery
- Endurance: 60 – 120 min
- Tether: none
- Control: remote teleop
- Sensors: future option
- Payload: 10 lbs (4.5 kg)
- Manipulator: future option

Radio TX: 900 MHz control, 2400 MHz video
Radio RX: 900 MHz control, 2400 MHz video




# Marv

Mesa Robotics, Inc.
www.mesa-robotics.com
256-464-7252/Mike Cole

**Manufacturer's Specs:**

- Width: 13.5" (34.29 cm)
- Length: 20.5" (52.07 cm)
- Height: 12" (30.48 cm)
- Weight: 25 lbs (11.33 kg)
- Turning Dia: zero in
- Max Speed: 4 mph (6.4 km/hr)
- Power Source: 12VDC, NiMH battery
- Endurance: 60 – 120 min
- Tether: none
- Control: remote teleop
- Sensors: future option
- Payload: 10 lbs (4.5 kg)
- Manipulator: future option

Radio TX: 900 MHz control, 2400 MHz video
Radio RX: 900 MHz control, 2400 MHz video

# Marv

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Marv

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Negotiator Tactical Surveillance Robot

Robotic FX, Inc.
www.RoboticFX.com
708-448-4264/Eric Webber

**Manufacturer's Specs:**

- Width: 16" - 22" (40.6-55.9 cm)
- Length: 25"(63.5 cm)
- Height: 7.6 in (19.3 cm)
- Weight: 25-35 lbs (11.3 -15.9 kg)
- Turning Diam: Turns in place
- Max Speed: 4.4-7.3 fps (1.3-2.2 mps)
- Power Source: battery (NiMH)
- Endurance: 180 to 360 min
- Tether (optional): comms
- Control: remote teleop, telemetry
- Sensors: All sensors (open system)
- Payload: Up Stairs = 10 lb (4.5 kg) / Flat Ground = 75 lb (34 kg)
- Manipulator: 6 DoFs, reach 42 in (106 cm)

Radio TX: Data 900 MHz / Video 2400MHz / (Opt.)Digital Video 300MHz UHF
Radio RX: Data 900 MHz / Video 2400MHz / (Opt.) Digital Video 300MHz UHF



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Radio TX: Data 900 MHz / Video 2400MHz / (Opt.)Digital Video 300MHz UHF
Radio RX: Data 900 MHz / Video 2400MHz / (Opt.) Digital Video 300MHz UHF

# Negotiator Tactical Surveillance Robot

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



Negotiator Tactical Surveillance Robot

Cache packaging, weight, setup, tools
Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

Confined Space
Minimum Height: _____ Time: _____
# Pallets

Directed Perception (boxes with holes):

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

Grasping Dexterity (shelves with objects):

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Incline Plane:
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

Mobility/Endurance (single charge):
Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

Radio Communications:
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

Random Maze:
Coverage: (x%), Time: (x min), Targets: (x of x)

Stairs:
Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

Visual Acuity:
Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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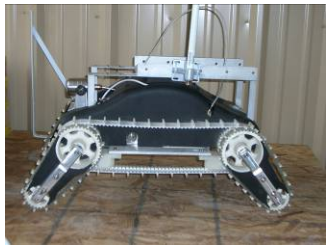
# Hero

First-Response Robotics, LLC
www.FirstResponseRobotics.com
513-752-6653 /Mike Cardarelli



**Manufacturer's Specs:**

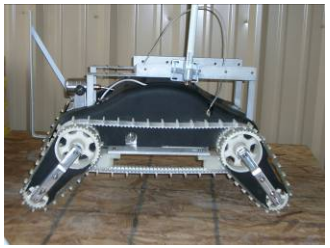
- Width: 21" (53 cm)
- Length: 36" (91 cm)
- Height: 17" (43 cm)
- Weight: 42 lbs (19 kg)
- Turning Diam: 0 m (0 cm)
- Max Speed: 10 fps (3 mps)
- Power Source: battery
- Endurance: 45 min
- Tether: none
- Control: remote teleop
- Sensors: radiation, biological
- Payload: 130 lb (59 kg)
- Manipulator: none

Radio TX: 72 MHz controller/1.0W (video), 2.4 MHz
900 MHz/0.5 W (telemetry), 1.2 MHz / 3W (video)



# Hero

First-Response Robotics, LLC
www.FirstResponseRobotics.com
513-752-6653 /Mike Cardarelli



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- Width: 21" (53 cm)
- Length: 36" (91 cm)
- Height: 17" (43 cm)
- Weight: 42 lbs (19 kg)
- Turning Diam: 0 m (0 cm)
- Max Speed: 10 fps (3 mps)
- Power Source: battery
- Endurance: 45 min
- Tether: none
- Control: remote teleop
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- Payload: 130 lb (59 kg)
- Manipulator: none

Radio TX: 72 MHz controller/1.0W (video), 2.4 MHz
900 MHz/0.5 W (telemetry), 1.2 MHz / 3W (video)

# Hero

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Hero

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Soryu

International Rescue System Institute
www.rescuesystem.org
Shigeo Hirose

**Manufacturer's Specs:**

- Width: 5.9" (15 cm)
- Length: 47.2" (120 cm)
- Height: 5.1" (13 cm)
- Weight: 28.6 lbs (13 kg)
- Turning Diam: 1.0 m
- Max Speed: 0.3 mps
- Power Source: battery
- Endurance: 20 min
- Tether: comms
- Control: remote teleop
- Sensors: thermal, camera, GAS(CO, O2, SO, CH)
- Payload: none
- Manipulator: none

Radio Tx: (tether only)
Radio Rx: (tether only)




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International Rescue System Institute
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Shigeo Hirose

**Manufacturer's Specs:**

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- Height: 5.1" (13 cm)
- Weight: 28.6 lbs (13 kg)
- Turning Diam: 1.0 m
- Max Speed: 0.3 mps
- Power Source: battery
- Endurance: 20 min
- Tether: comms
- Control: remote teleop
- Sensors: thermal, camera, GAS(CO, O2, SO, CH)
- Payload: none
- Manipulator: none

Radio Tx: (tether only)
Radio Rx: (tether only)

# Soryu

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Soryu

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Soryu V

International Rescue System Institute
www.rescuesystem.org
Shigeo Hirose

**Manufacturer's Specs:**

- Width: 7.9" (20.2 cm)
- Length: 45.6" – 54.3" (116 - 138 cm)
- Height: 5.7" (14.5 cm)
- Weight: 37.47 lbs (17 kg)
- Turning Diam: 50.3" (128 cm)
- Max Speed: 0.25 mps
- Power Source: battery (14.4V, 7400mAh)
- Endurance: 40 min
- Tether: comms
- Control: remote teleop
- Sensors: Camera
- Payload: unknown
- Manipulator: none

Radio Tx: (tether only)
Radio Rx: (tether only)




# Soryu V

International Rescue System Institute
www.rescuesystem.org
Shigeo Hirose

**Manufacturer's Specs:**

- Width: 7.9" (20.2 cm)
- Length: 45.6" – 54.3" (116 - 138 cm)
- Height: 5.7" (14.5 cm)
- Weight: 37.47 lbs (17 kg)
- Turning Diam: 50.3" (128 cm)
- Max Speed: 0.25 mps
- Power Source: battery (14.4V, 7400mAh)
- Endurance: 40 min
- Tether: comms
- Control: remote teleop
- Sensors: Camera
- Payload: unknown
- Manipulator: none

Radio Tx: (tether only)
Radio Rx: (tether only)

# Soryu V

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Soryu V

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# PackBot EOD

iRobot
www.irobot.com
781-345-0200/Jeff Ostazewski

**Manufacturer's Specs:**

- Width: 16"- 20" (40 - 50 cm )
- Length: 27" (69 cm)
- Height: 7.5" (19 cm)
- Weight: 48 lbs (22 kg)
- Turning Dia: 34" (86.36 cm)
- Max Speed: Variable 0 - 5 mph (0 - 8 km/hr)
- Power Source: battery
- Endurance: 2-12 hours / 6+ mi (10+ km)
- Tether: optional
- Control: Teleop
- Sensors: Zoom, FLIR cameras,omni direct mic
- Payload: 8 additional
- Manipulator: arm

Radio TX: 2400 MHz
Radio RX: 2400 MHz



# PackBot EOD

iRobot
www.irobot.com
781-345-0200/Jeff Ostazewski

**Manufacturer's Specs:**

- Width: 16"- 20" (40 - 50 cm )
- Length: 27" (69 cm)
- Height: 7.5" (19 cm)
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- Turning Dia: 34" (86.36 cm)
- Max Speed: Variable 0 - 5 mph (0 - 8 km/hr)
- Power Source: battery
- Endurance: 2-12 hours / 6+ mi (10+ km)
- Tether: optional
- Control: Teleop
- Sensors: Zoom, FLIR cameras,omni direct mic
- Payload: 8 additional
- Manipulator: arm

Radio TX: 2400 MHz
Radio RX: 2400 MHz

# PackBot EOD

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# PackBot EOD

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# PackBot Explorer

iRobot
www.irobot.com
781-345-0200/Jeff Ostazewski

**Manufacturer's Specs:**

- Width: 16" - 20" (40 - 50 cm)
- Length: 27"(69 cm)
- Height: 7.5" (19 cm)
- Weight: 48 lbs (22 kg)
- Turning Dia: 34" (86.36 cm)
- Max Speed: Variable 0 - 5 mph (0 - 8 km/hr)
- Power Source: battery
- Endurance: 2-12 hours / 6+ mi (10+ km)
- Tether: optional
- Control: Teleop
- Sensors: Zoom & FLIR cameras, omni dirc mic
- Payload: Supports up to 8
- Manipulator: surveillance head is mounted on a 12" (.3m) mast with a 360° pan and 270° tilt

Radio TX: 2400 MHz
Radio RX: 2400 MHz



# PackBot Explorer

iRobot
www.irobot.com
781-345-0200/Jeff Ostazewski

**Manufacturer's Specs:**

- Width: 16" - 20" (40 - 50 cm)
- Length: 27"(69 cm)
- Height: 7.5" (19 cm)
- Weight: 48 lbs (22 kg)
- Turning Dia: 34" (86.36 cm)
- Max Speed: Variable 0 - 5 mph (0 - 8 km/hr)
- Power Source: battery
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- Tether: optional
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- Sensors: Zoom & FLIR cameras, omni dirc mic
- Payload: Supports up to 8
- Manipulator: surveillance head is mounted on a 12" (.3m) mast with a 360° pan and 270° tilt

Radio TX: 2400 MHz
Radio RX: 2400 MHz

# PackBot Explorer

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**
Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**
Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**
Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**
Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# PackBot Explorer

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**
Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**
Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**
Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**
Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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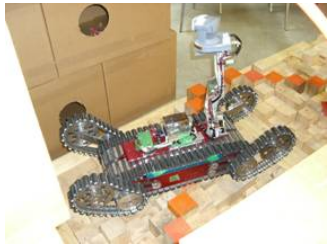
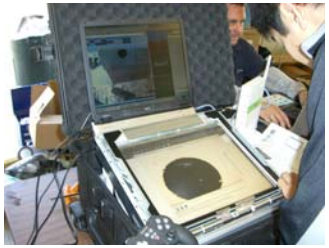
# Hibiscus

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org

**Manufacturer's Specs:**

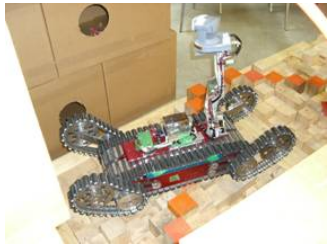
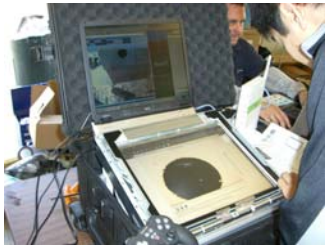
- Width: 14.5" (37 cm)
- Length: 38.5" (98 cm)
- Height: 7" (18 cm)
- Weight: 49.6 lbs (22.5 kg)
- Turn Diam: diagonal for skid steer
- Max Speed: .7 mph (1.2 km/ph)
- Power Source: battery
- Endurance: 60 min
- Tether: none
- Control Features: diagnostics, wall following, centering
- Sensors: URG,Heat, Voice
- Payload: none
- Manipulator: Sensor arm 4DOF: Length: 14.1" (36cm)

Radio TX: 2400 MHz
Radio RX: 2400 MHz



# Hibiscus

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org

**Manufacturer's Specs:**

- Width: 14.5" (37 cm)
- Length: 38.5" (98 cm)
- Height: 7" (18 cm)
- Weight: 49.6 lbs (22.5 kg)
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- Power Source: battery
- Endurance: 60 min
- Tether: none
- Control Features: diagnostics, wall following, centering
- Sensors: URG,Heat, Voice
- Payload: none
- Manipulator: Sensor arm 4DOF: Length: 14.1" (36cm)

Radio TX: 2400 MHz
Radio RX: 2400 MHz

# Hibiscus

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Hibiscus

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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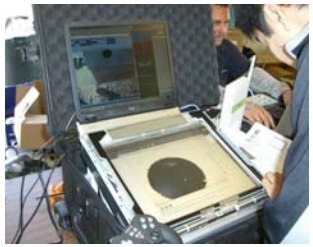
# Cphea

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org



**Manufacturer's Specs:**

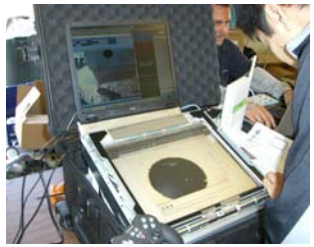
- Width: 20" (52 cm)
- Length: 40" (102 cm)
- Height: 9.4" (24 cm)
- Weight: 49.6 lbs (22.5 kg)
- Turn Diam: diagonal for skid steer
- Max Speed: .37 mph (0.6 km/ph)
- Power Source: battery
- Endurance: 60 min
- Tether: none
- Control: diagnostics, wall following, centering
- Sensors: URG,Heat, Voice
- Payload: none
- Manipulator: Sensor arm 2DOF: Length (30cm)

Radio TX: 2400 MHz
Radio RX: 2400 MHz



# Cphea

Toin University of Yokohama
Chiba Institute of Technology
koyanagi@furo.org



**Manufacturer's Specs:**

- Width: 20" (52 cm)
- Length: 40" (102 cm)
- Height: 9.4" (24 cm)
- Weight: 49.6 lbs (22.5 kg)
- Turn Diam: diagonal for skid steer
- Max Speed: .37 mph (0.6 km/ph)
- Power Source: battery
- Endurance: 60 min
- Tether: none
- Control: diagnostics, wall following, centering
- Sensors: URG,Heat, Voice
- Payload: none
- Manipulator: Sensor arm 2DOF: Length (30cm)

Radio TX: 2400 MHz
Radio RX: 2400 MHz

# Cphea

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Cphea

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Shinobi

Univ Electo-Communications
www.hi.mce.uec.ac.jp/matsuno-lab/matsuno_eng.html
Noritaka Sato

**Manufacturer's Specs:**

- Width: 15. 74" (40 cm)
- Length: 31.49" (80 cm)
- Height: 15-74" – 31.49" (40cm- 80cm)
- Weight: 57.32 lbs (26 kg)
- Turning Dia: 0
- Max Speed: .21 mps (.33 kms)
- Power Source: battery
- Endurance: 60 min
- Tether: none
- Control: teleop
- Sensors: thermal , chemical (cO2)
- Payload: none
- Manipulator: none

Radio TX: 5200 MhZ (10mW)
Radio RX: 5200 MhZ (10mW)



# Shinobi

Univ Electo-Communications
www.hi.mce.uec.ac.jp/matsuno-lab/matsuno_eng.html
Noritaka Sato

**Manufacturer's Specs:**

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- Length: 31.49" (80 cm)
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- Sensors: thermal , chemical (cO2)
- Payload: none
- Manipulator: none

Radio TX: 5200 MhZ (10mW)
Radio RX: 5200 MhZ (10mW)

# Shinobi

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Shinobi

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Matilda

Mesa Robotics, Inc.
www.mesa-robotics.com
256-464-7252/Mike Cole

**Manufacturer's Specs:**

- Width: 21" (53.34 cm)
- Length: 30" – 34" (76.2cm- 86.36cm)
- Height: 12" (30.48 cm)
- Weight: 61 lbs (27.66 kg)
- Turning Dia: zero
- Max Speed: 2.0 mph
- Power Source: 12VCD battery, NiMH
- Endurance: 360 – 480 min
- Tether: fiber optic cable (data,video, audio)
- Control: remote teleop
- Sensors: biological, chemical, radiological
- Payload: 125 lbs
- Manipulator: 5 DOF with 44 in reach (adds 45lbs/20.4kg to weight)

Radio TX: 900 MHz control, 1800 MHz video, 469 MHz audio
Radio RX: 900 MHz control, 1800 MHz video, 469 MHz audio




# Matilda

Mesa Robotics, Inc.
www.mesa-robotics.com
256-464-7252/Mike Cole

**Manufacturer's Specs:**

- Width: 21" (53.34 cm)
- Length: 30" – 34" (76.2cm- 86.36cm)
- Height: 12" (30.48 cm)
- Weight: 61 lbs (27.66 kg)
- Turning Dia: zero
- Max Speed: 2.0 mph
- Power Source: 12VCD battery, NiMH
- Endurance: 360 – 480 min
- Tether: fiber optic cable (data,video, audio)
- Control: remote teleop
- Sensors: biological, chemical, radiological
- Payload: 125 lbs
- Manipulator: 5 DOF with 44 in reach (adds 45lbs/20.4kg to weight)

Radio TX: 900 MHz control, 1800 MHz video, 469 MHz audio
Radio RX: 900 MHz control, 1800 MHz video, 469 MHz audio

# Matilda

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Matilda

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Chaos

Autonomous Solutions.
www.autonomoussolutions.com
Omar Salas

**Manufacturer's Specs:**

- Width: 28" (70 cm)
- Length: 28" (71 cm)
- Height: 8" (20 cm)
- Weight: 120 lbs (55 kg)
- Turning Dia: 39" ( 100)
- Max Speed: TBD
- Power Source: Lithium battery
- Endurance: 240 min
- Tether: None
- Control: remote teleop
- Sensors: 2 Cams
- Payload: TBD
- Manipulator: None

Radio TX: 2400 MHz/1000 mW (Video) 900 MHZ/1000 mW (data)
Radio RX: 2400 MHz/1000 mW (Video) 900 MHZ/1000 mW (data)



# Chaos

Autonomous Solutions.
www.autonomoussolutions.com
Omar Salas

**Manufacturer's Specs:**

- Width: 28" (70 cm)
- Length: 28" (71 cm)
- Height: 8" (20 cm)
- Weight: 120 lbs (55 kg)
- Turning Dia: 39" ( 100)
- Max Speed: TBD
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- Tether: None
- Control: remote teleop
- Sensors: 2 Cams
- Payload: TBD
- Manipulator: None

Radio TX: 2400 MHz/1000 mW (Video) 900 MHZ/1000 mW (data)
Radio RX: 2400 MHz/1000 mW (Video) 900 MHZ/1000 mW (data)

# Chaos

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Chaos

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# ATRV mini

Idaho National Lab
www.inl.gov/adaptiverobotics
208-526-8659 /Curtis Nielsen

**Manufacturer's Specs:**

- Width: 22" (55.8 cm)
- Length: 27" (68.6 cm)
- Height: 25" (63.5 cm)
- Weight: 125 lbs (56.7 kg)
- Turning Diam: 0 (turns on center off robot)
- Max Speed: 6.5 fps (2 mps)
- Power Source: battery
- Endurance: 30-45 min
- Tether: none
- Control: eyes-on, remote teleop, waypoints, go to landmarks, drive intent
- Sensors: color video, laser range scanner, ultrasonic sonar sensor.
- Payload: 35 lb (15.9 kg)
- Manipulator: none

Radio TX: 900 MHz (500 mW), 2400 MHz (500 mW)
Radio RX: 900 MHz (500 mW), 2400 MHz



# ATRV mini

Idaho National Lab
www.inl.gov/adaptiverobotics
208-526-8659 /Curtis Nielsen

**Manufacturer's Specs:**

- Width: 22" (55.8 cm)
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- Control: eyes-on, remote teleop, waypoints, go to landmarks, drive intent
- Sensors: color video, laser range scanner, ultrasonic sonar sensor.
- Payload: 35 lb (15.9 kg)
- Manipulator: none

Radio TX: 900 MHz (500 mW), 2400 MHz (500 mW)
Radio RX: 900 MHz (500 mW), 2400 MHz

# ATRV mini

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# ATRV mini

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Modular Logistics Platform

Segway, Inc.
www.segway.com
Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 33" (84 cm)
- Length: 26.5" (67 cm)
- Height: xxx" (xxx cm)
- Weight: 120 lbs (55 kg)
- Turning Dia: 42" (107 cm)
- Max Speed: 12.5 mph (20 km/h) Power Source: Two lithium-ion battery packs
- Endurance: 12 miles (19 km) off pavement
- Tether: None
- Control: dynamically stabilized, ride onboard, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders, camera
- Payload: 260 lb (118 kg)
- Manipulator: None

Radio TX: 2400 MHz/XXXmW (Video) 2400 MHZ/xxx mW (data)



# Modular Logistics Platform

Segway, Inc.
www.segway.com
Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 33" (84 cm)
- Length: 26.5" (67 cm)
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- Tether: None
- Control: dynamically stabilized, ride onboard, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders, camera
- Payload: 260 lb (118 kg)
- Manipulator: None

Radio TX: 2400 MHz/XXXmW (Video) 2400 MHZ/xxx mW (data)

# Modular Logistics Platform

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Modular Logistics Platform

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Talon

Foster-Miller
www.foster-miller.com/lemming.htm
781-684-3960/Joanne Maxwell

**Manufacturer's Specs:**

- Width: 16" (40.64 cm)
- Length: 19" (48.26 cm)
- Height: 11"-52" (27.9 c m - (132 cm)
- Weight: 115 to 140 lb (52kg to 64 kg)
- Turning Dia: turns in place
- Max Speed: 0 to 5.2 mph (0-8.3 km/hr
- Power Source: Single Lithium-ion Battery or Dual Lead-Acid Battery Pack
- Endurance: 4.5 hr (7.2 km/hr)
- Tether: Optional 300 or 500 m buffered fiber optic cable
- Control: digital/analog, 500-800 m LOS High Gain antenna range to 1200m LOS
- Sensors: Chemsentry 150 C, ADP 2000, RAE System MultiRAE, Canberra AN-UDR-14, RayTek temp. probe, targeting laser
- Payload: 100 lb (45 kg)
- Manipulator: 30 in-lb of gripping strength, 6 in wide opening, manual 340 degree wrist, OCU controllable 360 degree rotating wrist (optional)

Radio TX: Data 2400MHz / Video 1700-1800MHz
Radio RX: Data 2400MHz / Video 1700-1800MHz




# Talon

Foster-Miller
www.foster-miller.com/lemming.htm
781-684-3960/Joanne Maxwell

**Manufacturer's Specs:**

- Width: 16" (40.64 cm)
- Length: 19" (48.26 cm)
- Height: 11"-52" (27.9 c m - (132 cm)
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- Endurance: 4.5 hr (7.2 km/hr)
- Tether: Optional 300 or 500 m buffered fiber optic cable
- Control: digital/analog, 500-800 m LOS High Gain antenna range to 1200m LOS
- Sensors: Chemsentry 150 C, ADP 2000, RAE System MultiRAE, Canberra AN-UDR-14, RayTek temp. probe, targeting laser
- Payload: 100 lb (45 kg)
- Manipulator: 30 in-lb of gripping strength, 6 in wide opening, manual 340 degree wrist, OCU controllable 360 degree rotating wrist (optional)

Radio TX: Data 2400MHz / Video 1700-1800MHz
Radio RX: Data 2400MHz / Video 1700-1800MHz

# Talon

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Talon

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Talon-Hazmat

Foster-Miller
www.foster-miller.com/lemming.htm
Tim Everhard,/781-684-4225

**Manufacturer's Specs:**

- Width: 22.5 in (57.2 cm)
- Length: 34 in (86.4 cm)
- Height: 11 in (27.9 cm)
- Weight: 115 to 140 lb (52kg to 64 kg)
- Turning Dia: turns in place
- Max Speed: 7.6 fps (1.8mps)
- Power Source: Battery Pack
- Endurance: 4.5 hr (7.2 km/hr)
- Tether: none
- Control: remote teleop
- Sensors: chemical warfare agents (blood, nerve, blister), TIC, radiation
  Payload: 100 lb (45 kg)
- Manipulator: reach 52 in (1.3 m)

Radio TX: 1650-1900 MHz / 2000 mW (video), 148-174 MHz/ 600 mW (audio), 2.3-2.4 MHz / 5-500 mW (commands)




# Talon-Hazmat

Foster-Miller
www.foster-miller.com/lemming.htm
Tim Everhard,/781-684-4225

**Manufacturer's Specs:**

- Width: 22.5 in (57.2 cm)
- Length: 34 in (86.4 cm)
- Height: 11 in (27.9 cm)
- Weight: 115 to 140 lb (52kg to 64 kg)
- Turning Dia: turns in place
- Max Speed: 7.6 fps (1.8mps)
- Power Source: Battery Pack
- Endurance: 4.5 hr (7.2 km/hr)
- Tether: none
- Control: remote teleop
- Sensors: chemical warfare agents (blood, nerve, blister), TIC, radiation
  Payload: 100 lb (45 kg)
- Manipulator: reach 52 in (1.3 m)

Radio TX: 1650-1900 MHz / 2000 mW (video), 148-174 MHz/ 600 mW (audio), 2.3-2.4 MHz / 5-500 mW (commands)

# Talon-Hazmat

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)



# Talon-Hazmat

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Robotic Mobility Platform

**(RMP 200/INL)**

Segway, Inc.

www.segway.com/Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 29.5" (75 cm)
- Length: 25" 64 cm)
- Height: 24" (61 cm)
- Weight: 140 lbs (64 kg)
- Turning Dia: 39" (99 cm)
- Max Speed: 10 mph (16 km/h)
- Power Source: Two lithium-ion battery packs
- Endurance: 15 miles (24 km)
- Tether: None
- Control: dynamically stabilized, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders, camera, laser scanner for mapping
- Payload: 200 lb (91 kg)
- Manipulator: Barrett Technology WAM

Radio TX: 2400 MHz/XXXmW (Video) 900 MHZ/xxx mW (data)




# Robotic Mobility Platform

**(RMP 200/INL)**

Segway, Inc.

www.segway.com/Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 29.5" (75 cm)
- Length: 25" 64 cm)
- Height: 24" (61 cm)
- Weight: 140 lbs (64 kg)
- Turning Dia: 39" (99 cm)
- Max Speed: 10 mph (16 km/h)
- Power Source: Two lithium-ion battery packs
- Endurance: 15 miles (24 km)
- Tether: None
- Control: dynamically stabilized, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders, camera, laser scanner for mapping
- Payload: 200 lb (91 kg)
- Manipulator: Barrett Technology WAM

Radio TX: 2400 MHz/XXXmW (Video) 900 MHZ/xxx mW (data)

# Robotic Mobility Platform
## (RMP 200/INL)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Robotic Mobility Platform
## (RMP 200/INL)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Mini-Andros II

REMOTEC, Inc.
www.remotec-andros.com
865-483-0228/Jim Daniels

**Manufacturer's Specs:**

- Width: 24.5“ (62 cm)
- Length: 53“ (134c m)
- Height: 27“ (68 cm)
- Weight: 225 lbs (102.6 kg)
- Turning Dia: length of vehicle
- Max Speed: 1.1 mph(1.7 km/hr)
- Power Source: 24VDC - gel cell battery pack Battery
- Endurance: 3-6 hr
- Tether: Fiber-Optic Cable or hard tether cable
- Control: tethered,Radio Control
- Sensors: Color Camera
- Payload: 15 lbs (6.8 kg)
- Manipulator: 78” (2 m) telescoping arm with four degrees of freedom

Radio TX: tethered or RF
Radio RX: tethered or RF



# Mini-Andros II

REMOTEC, Inc.
www.remotec-andros.com
865-483-0228/Jim Daniels

**Manufacturer's Specs:**

- Width: 24.5“ (62 cm)
- Length: 53“ (134 cm)
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- Tether: Fiber-Optic Cable or hard tether cable
- Control: tethered,Radio Control
- Sensors: Color Camera
- Payload: 15 lbs (6.8 kg)
- Manipulator: 78” (2 m) telescoping arm with four degrees of freedom

Radio TX: tethered or RF
Radio RX: tethered or RF

# Mini-Andros II

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Mini-Andros II

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Robotic Mobility Platform

**(RMP 400/INL)**

Segway, Inc.

www.segway.com/Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 30" (76 cm)
- Length: 44" (112 cm)
- Height: 24" (61 cm)
- Weight: 240 lbs (109 kg)
- Turning Dia: 53" (135 cm)
- Max Speed: 18 mph (29 km/h)
- Power Source: Four lithium-ion battery packs
- Endurance: 15 miles (24 km)
- Tether: None
- Control: Statically stabilized, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders,
- Payload: 400 lb (180 kg)
- Manipulator: Barrett Technology WAM

Radio TX: 75 MHz/XXXmW (Video) 2400 MHZ/xxx mW (data)



# Robotic Mobility Platform

**(RMP 400/INL)**

Segway, Inc.

www.segway.com/Will Pong/603-222-6000

**Manufacturer's Specs:**

- Width: 30" (76 cm)
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- Control: Statically stabilized, remote teleoperative or autonomous
- Sensors: gyros, wheel encoders,
- Payload: 400 lb (180 kg)
- Manipulator: Barrett Technology WAM

Radio TX: 75 MHz/XXXmW (Video) 2400 MHZ/xxx mW (data)

# Robotic Mobility Platform
## (RMP 400/INL)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**
Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**
Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**
Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**
Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Robotic Mobility Platform
## (RMP 400/INL)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**
Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**
Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**
Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**
Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Andros F6A

REMOTEC, Inc.
www.remotec-andros.com
865-483-0228/Jim Daniels

**Manufacturer's Specs:**

- Width: 29" (73 cm
- Length: 52" (132 cm)
- Height: 56.5" (140 cm)
- Weight: 485 lb (219.99kg)
- Turning Dia: within the length of vehicle
- Max Speed: 3.5 mph (5.6 km/hr)
- Power Source: 24VDC 35 amp-hr gel-cell battery pack
- Endurance: 3-6 hr
- Tether: Interchangeable Fiber Optic Cable reel, RF system, or Hard-line cable reel system
- Control: tethered or RF
- Sensors: Color camera with low-light
- Payload: 45 lbs (20.4 kg)
- Manipulator: Arm -Vertical reach 109" (2.76 m) with tracks down and arm fully extended, Horizontal reach 56" (1.42 m) from front of vehicle

Radio TX: tethered or RF
Radio RX: tethered or RF



# Andros F6A

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- Control: tethered or RF
- Sensors: Color camera with low-light
- Payload: 45 lbs (20.4 kg)
- Manipulator: Arm -Vertical reach 109" (2.76 m) with tracks down and arm fully extended, Horizontal reach 56" (1.42 m) from front of vehicle

Radio TX: tethered or RF
Radio RX: tethered or RF

# Andros F6A

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# Andros F6A

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face Left \| C \| Right | | | Top (Near) Left \| C \| Right | | | Top (Far) Left \| C \| Right | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) Over \| Under \| Open | | | Top (Mid) Over \| Under \| Open | | | Top (Far) Over \| Under \| Open | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# teleMAX

**tele*rob*** GmbH

www.telerob.de

**Manufacturer's Specs:**

- Width: 15.75" (40 cm)
- Length: 31.5" - 63“ (80 cm – 160 cm)
- Height: 29.53" ( 75 cm) (stowed)
- Weight: 175 lbs (79.4 kg)
- Turning Dia: 39.37” (100cm)
- Max Speed: tracks 2.16 mph (3.5 kmh), wheels 2.92 mph (4.7 kmh)

  Power Source: NiMh, 24V DC
- Endurance: 2 hours
- Tether: none, fiber with video and comms
- Control: eyes-on, remote teleop
- Sensors: optional chemical, radiation, gas, GPS
- Payload: 22 lbs (10kg)
- Manipulator: 7 DOFs, reach 92,52 in to 102,36” (235 cm to 260 cm)

Radio TX: Data 433-435MHz/500mW, Video 2300 MHz/3W
Radio RX:




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- Manipulator: 7 DOFs, reach 92,52 in to 102,36” (235 cm to 260 cm)

Radio TX: Data 433-435MHz/500mW, Video 2300 MHz/3W
Radio RX:

# teleMax

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# teleMax

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

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Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# BOZ I

BOZ Robotics
www.bozrobot.com
847-574-0168/Jamie Alvarez

**Manufacturer's Specs:**

- Width: 26.4 in ( 67 cm)
- Length: 67.3 in (171 cm)
- Height: 53.2 in (135 cm)
- Weight: 1,300 lbs (600 kg)
- Turning Dia: 360 degrees
- Max Speed: 6.7 km/h
- Power Source: battery
- Endurance: 3 - 4 hrs to continuous w/generator
- Tether: 100 meter; 1 km remote los
- Control: computer w/case and joystick
- Sensors: ultra sound distance sensors (to the cm) 5 cameras; 3 infrared
- Payload: 265 lb (120 kg) lifting capacity w/arm straight; 441 lbs (200 kg) arm bent
- Manipulator: Hydraulic gripper w/12,717 lbs (5,770 kg) of opening force, reach 11.5 ft (350 cm) and four joints independently operated to tear off car doors, trunks, & dexterity to pour a soda bottle in a glass

Radio TX: 2400 MHz
Radio RX: 2400 MHz




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Radio TX: 2400 MHz
Radio RX: 2400 MHz

# BOZ I

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)




# BOZ I

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____ Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Confined Space**

Minimum Height: _____ Time: _____
# Pallets

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Ground Robots

**Grasping Dexterity (shelves with objects):**

| | Top (Near) | | | Top (Mid) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Over | Under | Open | Over | Under | Open | Over | Under | Open | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**

Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Mobility/Endurance (single charge):**

Terrain (flat): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (ramps): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)
Terrain (stepfields): # pallets, time (x hrs.), MTBF: (x hrs.), Field maint. (x min.)

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Random Maze:**

Coverage: (x%), Time: (x min), Targets: (x of x)

**Stairs:**

Max. Degrees: 30 / 45 / 60: Time (Ascend: x min., Descend (Time: x min.)

**Visual Acuity:**

Ambient (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Dark (x lumens): Near: normal (x.x); zoom (x.x), Far: normal (x.x); zoom (x.x)
Var. illumination: (yes/no); Field of View (x deg); Pan (x deg); Tilt (x deg)

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# Wall Climbers





# Wall Climbers

Wall Climbers

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# VMRP

Vortex HC LLC.
www.vortexhc.com
919-462-8828

**Manufacturer's Specs:**

- Width: 8.5" (21.5 cm)
- Length: 6.5" (16.5 cm)
- Height: 4" (10 cm)
- Weight: 1.87 lbs (.84kg)
- Turning Dia: TBD
- Max Speed: 6"/sec. (.154m/sec)
- Power Source: battery
- Endurance: 20- 40 minutes
- Tether: none
- Control: teleoped
- Sensors: 2 color camera ( boom pan drive camera)
- Payload: 1 lbs (.45kg) (scalable)
- Manipulator: n/a

Radio TX: 2400 MHz (Bluetooth) video 1200 MHz
Radio RX: 2400 MHz (Bluetooth)




# VMRP

Vortex HC LLC.
www.vortexhc.com
919-462-8828

**Manufacturer's Specs:**

- Width: 8.5" (21.5 cm)
- Length: 6.5" (16.5 cm)
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- Weight: 1.87 lbs (.84kg)
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- Power Source: battery
- Endurance: 20- 40 minutes
- Tether: none
- Control: teleoped
- Sensors: 2 color camera ( boom pan drive camera)
- Payload: 1 lbs (.45kg) (scalable)
- Manipulator: n/a

Radio TX: 2400 MHz (Bluetooth) video 1200 MHz
Radio RX: 2400 MHz (Bluetooth)

# VMRP

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Wall Climbers




# VMRP

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Wall Climbers

# NanoMag

Inuktun
www.inuktun.com/
1-877-468-5886

**Manufacturer's Specs:**

- Width: 17 " (43.1cm )
- Length: 12" (30.4 cm)
- Height: 3.5" (8.8 cm)
- Weight: 5 lbs (2.26kg)
- Turning Dia: TBD
- Max Speed: 0-5 ft/min (0-1.5 m/min)
- Power Source: TBD
- Endurance: TBD
- Tether: 100ft (30m)
- Control: teleoped
- Sensors: TBD
- Payload: TBD
- Manipulator: n/a

Radio Tx: (tether only)
Radio Rx: (tether only)



# NanoMag

Inuktun
www.inuktun.com/
1-877-468-5886

**Manufacturer's Specs:**

- Width: 17 " (43.1cm )
- Length: 12" (30.4 cm)
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- Power Source: TBD
- Endurance: TBD
- Tether: 100ft (30m)
- Control: teleoped
- Sensors: TBD
- Payload: TBD
- Manipulator: n/a

Radio Tx: (tether only)
Radio Rx: (tether only)

# NanoMag

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Wall Climbers



# NanoMag

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Incline Plane:**
Max. Operating Angle: Grnd. (20, 30, 40, 50, 60, 70, 80), Wall: (90), Inverted: (100, 135, 180)

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Wall Climbers

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# Aerial Robots





Aerial Robots

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# Blimp

ARACAR
www.aracar.org/index.html
985-845-3774

**Manufacturer's Specs:**

- Length: 10' -20' (3 m-6 m)
- Weight: < 0! lbs (< 0! kg)
- Range: 150 ft (50 m) tethered
- Speed: 0 km/hr (or tether vehicle speed)
- Launch: vertical pay out of tether
- Recovery: vertical retrieval of tether
- Propulsion: none
- Altitude: 150 ft (50 m)
- Endurance: TBD
- Control: none
- Payload: small camera

Radio TX:
Radio RX:



# Blimp

ARACAR
www.aracar.org/index.html
985-845-3774

**Manufacturer's Specs:**

- Length: 10' -20' (3 m-6 m)
- Weight: < 0! lbs (< 0! kg)
- Range: 150 ft (50 m) tethered
- Speed: 0 km/hr (or tether vehicle speed)
- Launch: vertical pay out of tether
- Recovery: vertical retrieval of tether
- Propulsion: none
- Altitude: 150 ft (50 m)
- Endurance: TBD
- Control: none
- Payload: small camera

Radio TX:
Radio RX:

# Blimp

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)






# Blimp

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Nighthawk

Applied Research Associates, Inc
www.ara.com
Adam Sloan/asloan@ara.com

**Manufacturer's Specs:**

- Wingspan: 2.2 ft (0.66 m)
- Length: 1.7 ft (0.51 m)
- Weight: 1.65 lbs (0.750 kg)
- Range: 6.2 miles (10 km)
- Speed: 28 mph (44 kmph)
- Launch: hand
- Recovery: skid land
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 60-90 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:915-928 MHz / 650 mW/2409-2469 MHz / 600 mW
Radio RX:



# Nighthawk

Applied Research Associates, Inc
www.ara.com
Adam Sloan/asloan@ara.com

**Manufacturer's Specs:**

- Wingspan: 2.2 ft (0.66 m)
- Length: 1.7 ft (0.51 m)
- Weight: 1.65 lbs (0.750 kg)
- Range: 6.2 miles (10 km)
- Speed: 28 mph (44 kmph)
- Launch: hand
- Recovery: skid land
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 60-90 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:915-928 MHz / 650 mW/2409-2469 MHz / 600 mW
Radio RX:

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# Nighthawk

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# Nighthawk

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# TACMAV

Applied Research Associates

**Manufacturer's Specs:**

- Wingspan: 1.75 ft (0.53 m)
- Length: 1.65 ft (0.50 m)
- Weight: xx lbs (xx kg)
- Range: xx miles (xx km)
- Speed: 49.7 mph (80 km/hr)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 25-50 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:



TACMAV

Applied Research Associates

**Manufacturer's Specs:**

- Wingspan: 1.75 ft (0.53 m)
- Length: 1.65 ft (0.50 m)
- Weight: xx lbs (xx kg)
- Range: xx miles (xx km)
- Speed: 49.7 mph (80 km/hr)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 25-50 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:

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# TACMAV

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)





TACMAV

Aerial Station Keeping (single charge):

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

Cache packaging, weight, setup, tools

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

Directed Perception (boxes with holes):

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Radio Communications:

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

Visual Acuity:

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# AirRobot

AirRobot GmbH
www.AirRobot.com
49 2932 54 77 40/info@airrobot.de

**Manufacturer's Specs:**

- Rotor span: 36” (1097 cm)
- Length: 36” (1097 cm) diameter
- Weight: less than 2.2 lbs (less than 1 kg)
- Range: up to 1640 ft (up to 500 m)
- Speed: approximate 25 mph
- Launch: vertical
- Recovery: vertical
- Propulsion: electric, LiPo Battery 14.8 V, 2.05 Ah
- Altitude: up to 492 ft (150m)
- Endurance: 20-25 min
- Control: video glasses or Tablet PC
- Payload: 0.44 lb (0.2 kg)

Radio TX: 35 MHz (200 mW)
Radio RX: 35 MHz Video 1420 MHz



# AirRobot

AirRobot GmbH
www.AirRobot.com
49 2932 54 77 40/info@airrobot.de

**Manufacturer's Specs:**

- Rotor span: 36” (1097 cm)
- Length: 36” (1097 cm) diameter
- Weight: less than 2.2 lbs (less than 1 kg)
- Range: up to 1640 ft (up to 500 m)
- Speed: approximate 25 mph
- Launch: vertical
- Recovery: vertical
- Propulsion: electric, LiPo Battery 14.8 V, 2.05 Ah
- Altitude: up to 492 ft (150m)
- Endurance: 20-25 min
- Control: video glasses or Tablet PC
- Payload: 0.44 lb (0.2 kg)

Radio TX: 35 MHz (200 mW)
Radio RX: 35 MHz

# AirRobot

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# AirRobot

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Dragon Eye

AeroVironment Inc.
www.avsuav.com
626-357-9983

**Manufacturer's Specs:**

- Wingspan: 3 ft (0.9 m)
- Length: 3 ft (0.9 m)
- Weight: 5.9 lbs (2.7kg)
- Range: 3.1 mile (5 km)
- Speed:
  Launch: 21.7 mph (35 km/hr bungee
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 45-60 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:



# Dragon Eye

AeroVironment Inc.
www.avsuav.com
626-357-9983

**Manufacturer's Specs:**

- Wingspan: 3 ft (0.9 m)
- Length: 3 ft (0.9 m)
- Weight: 5.9 lbs (2.7kg)
- Range: 3.1 mile (5 km)
- Speed:
  Launch: 21.7 mph (35 km/hr bungee
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 45-60 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:

# Dragon Eye

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)





Dragon Eye

Aerial Station Keeping (single charge):

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

Cache packaging, weight, setup, tools

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

Directed Perception (boxes with holes):

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Radio Communications:

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

Visual Acuity:

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Cyberbug

CyberDefense Systems
www.cyberdefensesystems.com/
Billy Robinson/727-577-0878

**Manufacturer's Specs:**

- Wingspan: 3.5 ft (1.1 m)
- Length: 3.5 ft (1.1 m)
- Weight: 7 lbs (3.2 kg)
- Range: 6.2 miles (10 km)
- Speed: 24.85 mph (40 km/hr)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 45 min
- Control:
  Payload: auto waypoint following
  color camera, infrared

Radio TX: 900 MHz – 2400 MHz
Radio RX:



# Cyberbug

CyberDefense Systems
www.cyberdefensesystems.com/
Billy Robinson/727-577-0878

**Manufacturer's Specs:**

- Wingspan: 3.5 ft (1.1 m)
- Length: 3.5 ft (1.1 m)
- Weight: 7 lbs (3.2 kg)
- Range: 6.2 miles (10 km)
- Speed: 24.85 mph (40 km/hr)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 45 min
- Control:
  Payload: auto waypoint following
  color camera, infrared

Radio TX: 900 MHz – 2400 MHz
Radio RX:

# CyberBug

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# CyberBug

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Raven

AeroVironment Inc.
www.avsuav.com
626-357-9983

**Manufacturer's Specs:**

- Wingspan: 4.5 ft (1.4 m)
- Length: 3 ft (0.9 m)
- Weight: 4.2 lbs (1.9 kg)
- Range: 6.2 miles (10 km)
- Speed: 20-50 mph ( 32-82 km/hr)
- Launch: hand
- Recovery: deep stall vertical
  Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 80-110 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:




# Raven

AeroVironment Inc.
www.avsuav.com
626-357-9983

**Manufacturer's Specs:**

- Wingspan: 4.5 ft (1.4 m)
- Length: 3 ft (0.9 m)
- Weight: 4.2 lbs (1.9 kg)
- Range: 6.2 miles (10 km)
- Speed: 20-50 mph ( 32-82 km/hr)
- Launch: hand
- Recovery: deep stall vertical
  Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 80-110 min
- Control: auto waypoint following
- Payload: color camera, infrared

Radio TX:
Radio RX:

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# Raven

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# Raven

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Evolution-XTS

BAI Aerosystems
Kirk Jenkins/ 410-820-8500

**Manufacturer's Specs:**

- Wingspan: 5.4 ft (1.6 m)
- Length: 3.2 ft (1.0 m)
- Weight: 8.2 lbs (3.7 kg)
- Range: 10000 m LOS
- Speed: 30-50mph (48-81 kmph)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 90 min
- Control: auto waypoint following
- Payload: color camera, infrared bio/chemical

Radio TX: 399.37 MHz / 1500 mW
Radio RX:



# Evolution-XTS

BAI Aerosystems
Kirk Jenkins/ 410-820-8500

**Manufacturer's Specs:**

- Wingspan: 5.4 ft (1.6 m)
- Length: 3.2 ft (1.0 m)
- Weight: 8.2 lbs (3.7 kg)
- Range: 10000 m LOS
- Speed: 30-50mph (48-81 kmph)
- Launch: hand
- Recovery: horizontal landing
- Propulsion: electric motor
- Altitude: 100-500 ft (30.48m-152.4m) AGL
- Endurance: 90 min
- Control: auto waypoint following
- Payload: color camera, infrared bio/chemical

Radio TX: 399.37 MHz / 1500 mW
Radio RX:

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# Evolution-XTS

**Aerial Station Keeping (single charge):**
Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**
Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots



Evolution-XTS

Aerial Station Keeping (single charge):
Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

Cache packaging, weight, setup, tools
Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____
Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

Directed Perception (boxes with holes):

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

Radio Communications:
LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

Visual Acuity:
Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)
Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Flying Bassett

University of Alabama in Huntsville (UAH)
Gary Maddux/gary.maddux@us.army.mil

**Manufacturer's Specs:**

- Rotor span: 6 ft (1.8 m)
- Length: 7 ft (2.13 m)
- Weight: 45 lbs (20.4 kg)
- Range: 0.5 mi (0.81km) LOS, Further with GCS
- Speed: 5 mph (8.1km/hr)
- Launch: vertical takeoff
- Recovery: vertical landing
- Propulsion: Zenoah 80cc 8 hp Twin ylinder, Gasoline
- Altitude: 500 ft (152 m)
- Endurance: 20 min
- Control: auto waypoint following
- Payload:

Radio TX: 72.230 MHz / 100 mW
Radio RX:



# Flying Bassett

University of Alabama in Huntsville (UAH)
Gary Maddux/gary.maddux@us.army.mil

**Manufacturer's Specs:**

- Rotor span: 6 ft (1.8 m)
- Length: 7 ft (2.13 m)
- Weight: 45 lbs (20.4 kg)
- Range: 0.5 mi (0.81km) LOS, Further with GCS
- Speed: 5 mph (8.1km/hr)
- Launch: vertical takeoff
- Recovery: vertical landing
- Propulsion: Zenoah 80cc 8 hp Twin ylinder, Gasoline
- Altitude: 500 ft (152 m)
- Endurance: 20 min
- Control: auto waypoint following
- Payload:

Radio TX: 72.230 MHz / 100 mW
Radio RX:

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# Flying Bassett

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# Flying Bassett

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

# Yamaha Helicopter

SkeyesUnlimited Inc.
www.skeyesunlimited.com/index.html
412-661-0292

**Manufacturer's Specs:**

- Rotor span: 10.2 ft (3.1 m)
- Length: 11.8 ft (3.6 m)
- Weight: 207 lbs (94 kg)
- Range: 492 ft (150 m) LOS
- Speed: TBD
- Launch: vertical takeoff
- Recovery: vertical landing
- Propulsion: 21 hp, 246 cc, 2-stroke, gas/oil mix
- Altitude: TBD
- Endurance: 60 min
- Control: auto waypoint following
- Payload: 3-D laser scanner

Radio TX: TBD
Radio RX: TBD



# Yamaha Helicopter

SkeyesUnlimited Inc.
www.skeyesunlimited.com/index.html
412-661-0292

**Manufacturer's Specs:**

- Rotor span: 10.2 ft (3.1 m)
- Length: 11.8 ft (3.6 m)
- Weight: 207 lbs (94 kg)
- Range: 492 ft (150 m) LOS
- Speed: TBD
- Launch: vertical takeoff
- Recovery: vertical landing
- Propulsion: 21 hp, 246 cc, 2-stroke, gas/oil mix
- Altitude: TBD
- Endurance: 60 min
- Control: auto waypoint following
- Payload: 3-D laser scanner

Radio TX: TBD
Radio RX: TBD

# Yamaha Helicopter

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots




# Yamaha Helicopter

**Aerial Station Keeping (single charge):**

Targets: (flush: x of x), (recessed: x of x), Total: (y of y), Time: (x min.)

**Cache packaging, weight, setup, tools**

Packages: Ropacks _____ Pelicans _____ Hardiggs _____Pallets _____

Weights: Shipping _____ Deployed _____ Setup Time: X min. Tools: standard

**Directed Perception (boxes with holes):**

| | Face | | | Top (Near) | | | Top (Far) | | | Time | Contacts |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | C | Right | Left | C | Right | Left | C | Right | | |
| Level 4: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 3: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 2: | x | x | x | x | x | x | x | x | x | x min. | # |
| Level 1: | x | x | x | x | x | x | x | x | x | x min. | # |

**Radio Communications:**

LOS: (x m, time, near field acuity), BLOS: (x m, time, near field acuity)

**Visual Acuity:**

Ambient (x lumens): near field (x.x), far field (x.x), zoom (x.x)

Dark (x lumens): near field (x.x), far field (x.x), zoom (x.x) – var. illumination: (yes/no)

Aerial Robots

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# Aquatic Robots





Aquatic Robots

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# VideoRay Pro 3

VideoRay
www.videoray.com/index.htm

Manufacturer's Specs:

- Width: 9" (22.5 cm)
- Length: 12" (30.5 cm)
- Height: 8.5" (21 cm)
- Weight: Submersible: 8.4 lbs (3.8 kg), Total System: 90 lbs
- Depth Rating 500 ft (152 m)
- Max Speed: 2.6 knots
- Power Source: Battery Pack
- Endurance: xx
- Tether: power, comms, 250 ft (75 m)
- Control: remote teleop
- Sensors: front/rear camera, scanning sonar (seasprite)
- Payload: xxx
- Manipulator: 10" (25 cm) gripper accessory



# VideoRay Pro 3

VideoRay
www.videoray.com/index.htm

Manufacturer's Specs:

- Width: 9" (22.5 cm)
- Length: 12" (30.5 cm)
- Height: 8.5" (21 cm)
- Weight: Submersible: 8.4 lbs (3.8 kg), Total System: 90 lbs
- Depth Rating 500 ft (152 m)
- Max Speed: 2.6 knots
- Power Source: Battery Pack
- Endurance: xx
- Tether: power, comms, 250 ft (75 m)
- Control: remote teleop
- Sensors: front/rear camera, scanning sonar (seasprite)
- Payload: xxx
- Manipulator: 10" (25 cm) gripper accessory

Aquatic Robots

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# Sensors



# Sensors

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Sensors

# GammaRAE II Responder

RAE Systems, Inc
www.raesystems.com

- Width: 2.7 “(6.8 cm)
- Length: 4.9 “ (12.5 cm)
- Height: 1.4 “(3.5 cm)
- Weight: 0.625 lbs (0.24 kg)
- Sensitivity: (Cs-137, Co-60, Am-241)
- Energy range: 60 keV to 3.0 MeV
- Exposure rate range: 1 µR/h to 10 R/h
- Response with angle if incidence: ±20% from 0° for -45° to 45° (Cs-137)
- Type of detector: CsI(Tl)+photodiode & energy-compensated PIN diode
- Data transmission type: Bluetooth
- Battery type and lifetime: 2xAA alkaline, 500hr
- Display type: Backlit LCD
- Alarm type: Audible, Visual LEDs, Built-in vibration
- Control: Manual
- Radio frequency immunity:
- Radiated emission: omplies with FCC Part 15
- Shock resistance: from 59” Passes drop tests (1.5 m)



# GammaRAE II Responder

RAE Systems, Inc
www.raesystems.com

- Width: 2.7 “(6.8 cm)
- Length: 4.9 “ (12.5 cm)
- Height: 1.4 “(3.5 cm)
- Weight: 0.625 lbs (0.24 kg)
- Sensitivity: (Cs-137, Co-60, Am-241)
- Energy range: 60 keV to 3.0 MeV
- Exposure rate range: 1 µR/h to 10 R/h
- Response with angle if incidence: ±20% from 0° for -45° to 45° (Cs-137)
- Type of detector: CsI(Tl)+photodiode & energy-compensated PIN diode
- Data transmission type: Bluetooth
- Battery type and lifetime: 2xAA alkaline, 500hr
- Display type: Backlit LCD
- Alarm type: Audible, Visual LEDs, Built-in vibration
- Control: Manual
- Radio frequency immunity:
- Radiated emission: omplies with FCC Part 15
- Shock resistance: from 59” Passes drop tests (1.5 m)

# ICS-4000 Radionuclide Identifier

XRF Corporation
www.xrfcorp.com / www.laurussystems.com
410-465-5558

- Width: 3.4"
- Length: 10.2”
- Height: 1.2”
- Weight: 1.75 lbs
- Sensitivity: Cs-137: 90 cps/mR/h, Co-60: 25 cps/mR/h, Am-241: 2900 cps/mR/h
- Energy range: 10 keV – 2 MeV
- Exposure rate range: 50 mR/h – 1 R/h
- Response with angle if incidence: -3.3% 0° for -45° to 45° (Cs-137)
- Type of detector: Solid state CdTe for dose rate & radionuclide ID
- Data transmission type: Bluetooth
- Battery type and lifetime: 24 hours
- Display type: LCD w LED backlight
- Alarm type: Audible & visual
- Control: Remote / manual
- Radio frequency immunity: Class A per standard EN 61326 (1997) + A1 (1998) + A2 (2001)
- Radiated emission: Class B per standard EN 61326 (1997) + A1 (1998) + A2 (2001)
- Shock resistance: Conditional per ANSI N42.34





# ICS-4000 Radionuclide Identifier

XRF Corporation
www.xrfcorp.com / www.laurussystems.com
410-465-5558

- Width: 3.4"
- Length: 10.2”
- Height: 1.2”
- Weight: 1.75 lbs
- Sensitivity: Cs-137: 90 cps/mR/h, Co-60: 25 cps/mR/h, Am-241: 2900 cps/mR/h
- Energy range: 10 keV – 2 MeV
- Exposure rate range: 50 mR/h – 1 R/h
- Response with angle if incidence: -3.3% 0° for -45° to 45° (Cs-137)
- Type of detector: Solid state CdTe for dose rate & radionuclide ID
- Data transmission type: Bluetooth
- Battery type and lifetime: 24 hours
- Display type: LCD w LED backlight
- Alarm type: Audible & visual
- Control: Remote / manual
- Radio frequency immunity: Class A per standard EN 61326 (1997) + A1 (1998) + A2 (2001)
- Radiated emission: Class B per standard EN 61326 (1997) + A1 (1998) + A2 (2001)
- Shock resistance: Conditional per ANSI N42.34

# Inspector-1000

Canberra Industries
www.canberra.com

- Width: 7.5 in (19 cm)
- Length: 6.5 in (16.5 cm)
- Height: 2.5 in (6.4 cm)
- Weight: 2.2 lbs (1.0 kg)
- Sensitivity: (Cs-137, Co-60, Am-241)
- Energy range: 50-3000 keV
- Exposure rate range: 1000 mR/h
- Response with angle if incidence: 95% from 0° for -45° to 45° (Cs-137)
- Type of detector: GM + (either NaI(Tl) or LaBr) with radionuclide ID
- Data transmission type: USB
- Battery type and lifetime: 12, hours
- Display type: LCD 320 x 200 Hi-res color display
- Alarm type: audible, visual
- Control: eyes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes



# Inspector-1000

Canberra Industries
www.canberra.com

- Width: 7.5 in (19 cm)
- Length: 6.5 in (16.5 cm)
- Height: 2.5 in (6.4 cm)
- Weight: 2.2 lbs (1.0 kg)
- Sensitivity: (Cs-137, Co-60, Am-241)
- Energy range: 50-3000 keV
- Exposure rate range: 1000 mR/h
- Response with angle if incidence: 95% from 0° for -45° to 45° (Cs-137)
- Type of detector: GM + (either NaI(Tl) or LaBr) with radionuclide ID
- Data transmission type: USB
- Battery type and lifetime: 12, hours
- Display type: LCD 320 x 200 Hi-res color display
- Alarm type: audible, visual
- Control: eyes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes

# Radiogem

Canberra Industries
www.canberra.com

- Width: 5.9 in (15.0 cm)
- Length: 3.3 in (8.5 cm)
- Height: 1.8 in (4.5 cm)
- Weight: .66 lbs(0.300 kg)
- Sensitivity: yes (Cs-137, Co-60, Am-241)
- Energy range: 30 - 2000 keV ( probe dep. )
- Exposure rate range: 0.03-10,000mR/h
- Response with angle if incidence: 95% from 0° for -45° to 45° (Cs-137)
- Type of detector: GM, or NaI, Plastic
- Data transmission type: RS-232
- Battery type and lifetime: 80 hours
- Display type: LCD display
- Alarm type: audible, visual
- Control: eyes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes



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- Data transmission type: RS-232
- Battery type and lifetime: 80 hours
- Display type: LCD display
- Alarm type: audible, visual
- Control: eyes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes

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Sensors

# UltraRadiac

Canberra Industries
www.canberra.com

- Width: 2.61 in (6.6 cm)
- Length: 3.95 in (10.0 cm)
- Height: 1.14 in (2.9 cm)
- Weight: .6 lbs (0.269 kg)
- Sensitivity: yes (Cs-137, Co-60, Am-241)
- Energy range: 60 - 1300 keV
- Exposure rate range: 0.001 – 500,000 mR/h
- Response with angle if incidence: 45° to 45° (Cs- 95% from 0° for -137)
- Type of detector: GM
- Data transmission type: RS-232
- Battery type and lifetime: 150 hours
- Display type: LCD display
- Alarm type: audible, visual, vibration
- Control: yes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes



# UltraRadiac

Canberra Industries
www.canberra.com

- Width: 2.61 in (6.6 cm)
- Length: 3.95 in (10.0 cm)
- Height: 1.14 in (2.9 cm)
- Weight: .6 lbs (0.269 kg)
- Sensitivity: yes (Cs-137, Co-60, Am-241)
- Energy range: 60 - 1300 keV
- Exposure rate range: 0.001 – 500,000 mR/h
- Response with angle if incidence: 45° to 45° (Cs- 95% from 0° for -137)
- Type of detector: GM
- Data transmission type: RS-232
- Battery type and lifetime: 150 hours
- Display type: LCD display
- Alarm type: audible, visual, vibration
- Control: yes-on, manual
- Radio frequency immunity: yes
- Radiated emission: yes
- Shock resistance: yes

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