Unmanned Vehicle Development for Military Applications

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Unmanned Systems Development

Unmanned Aerial Vehicles
ADE, VRDE, R&DE(E)

Mobile Robots

Autonomous Underwater Vehicles
NSTL

Unmanned Ground Vehicles
CVRDE, VRDE, R&DE(E), CAIR
DRDO SCENARIO

AIR

WATER

LAND
UGV - Application Areas

- Low Intensity Conflict Operations
- Combat Engineering
- Weaponised Platforms
- Hazardous Mission Specific
- Communications
- Reconnaissance
- Surveillance
ROBOTICS DEVELOPMENT CENTRE

working on development of

Unmanned Systems for Surveillance
& Hazardous Material Handling

OBJECTIVE

• Products aimed at Combat Engineering Applications

• Multiple utilization for Counter Terrorist & Counter Insurgency Operations

• Aimed at Surveillance & Hazardous Material Handling viz. suspected objects and baggage, IEDs, UXOs, Mines and Radiation and Chemically contaminated objects
ROBOTICS SYSTEMS DEVELOPMENT PLAN

PAST

ROV – ‘Daksh’

UAV – ‘Netra’

PRESENT

CBRNe ROV and UAV UXO Handling Robot

FUTURE

Gun Mounted ROV
Surveillance ROV
Confined Space ROV
ROBOTICS SYSTEMS DEVELOPMENT - PAST

REoterely Operated Vehicle - DAKSH

SALIENT FEATURES

- Cross Country and Urban deployment
- Stair Climbing Capability
- Range : 500 m LOS
- 3 hours endurance on battery
- Optional 230 V AC operation
- 6 DOF Manipulator Arm
- Lift Capacity 20 Kg @ 2.5m
- Interchangeable Grippers
- Built-in X-Ray interface for detection
- Water Jet Disrupter for diffusing IED
- Additional 12 bore shotgun
- Specially designed Carrier Vehicle

Status – Introduced into Services, Limited Series Production of 20 nos. completed
DAKSH – SUBSYSTEMS & COMPONENTS

Challenges faced
- First time effort nationally, no previous benchmark
- Integration of Multiple (multi-domain) Technologies
- From Concept to Product in 30 months
- TOT and establishment of Production processes
ROV – ‘DAKSH’ – CHRONOLOGY OF DEVELOPMENT

CONCEPT PROTOTYPE

PROTO-1 WITH INTEGRATED TRACK

PROTO-2 WITH LINEAR ACTUATOR BASED ARM
ROV – ‘DAKSH’ – CHRONOLOGY OF DEVELOPMENT

PROTO-3 WITH ROTARY ACTUATOR BASED ARM

PROTO-4 FOR V & V TRIALS

FIRST-OFF PRODUCTION

ADVANCED SYSTEMS GROUP - ROBOTICS
REMOTELY OPERATED VEHICLE - DAKSH

ROV – ‘DAKSH’ – *from Concept to Product*

- Parallel Paths
  - Indigenous components
  - Imported components
- Refinement through iterations
- Key sub-system design
- COTS components
- Software in-house
- Industry participation
- Industrial Product Design
EXTRACTING IED UNDER CULVERT
IED SUCCESSFULLY EXTRACTED
PRESSURE COOKER IED GRIPPED BY 3 FINGER GRIPPER
PRESSURE COOKER IED SUCCESSFULLY EXTRACTED
DAKSH NEGOTIATING LOOSE SAND NEAR CHENAB
X RAY TRIALS
### SUMMARY OF TRIALS

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*Comparative Trials*

20+ observations of DAKSH’s winning edge over REMOTEC

**Remarks** - Indigenous Development, Easy Maintenance, Availability of Spares & Cost
UNMANNED AERIAL VEHICLE – ‘NETRA’

........a new approach for product realization
UNMANNED AERIAL VEHICLE – ‘NETRA’

SALIENT FEATURES

- Joint development (PPP) with M/s Ideaforge Ltd.
- Weight – 3.5 Kg
- Range - 4 km LOS
- Endurance – 40 minutes
- VTOL capability
- Daylight Camera with 10X zoom
- Night Flying using Thermal Imager
- Fully Autonomous Operation
- Failsafe features
  - Low Battery
  - Communication Loss
- Ground Control Station – Backpack based

Status – 25+ nos. being exploited in the field
NETRA flew about 3000 ft. high from MARHI, HP (12467 ft.), i.e. a total of 15476 ft. (approx.) from Mean Sea Level
UNMANNED AERIAL VEHICLE- ‘NETRA’ @ Leh
Trials with Navy

Ship Launch and recovery, Boat launch and recovery, Night Operations
Trials with Navy

Ship Launch and recovery, Boat launch and recovery, Night Operations
Ongoing Projects
CBRNe ROV (Chemical, Biological, Radiological, Nuclear & Explosive)

A Platform to detect CBRNe contamination remotely

SENSORS FOR DETECTION

CHEMICAL SENSOR – Chempro DM
Mass Spectrometry, Agents – GA, GB, GD, VX, HD and L

BIOLOGICAL SENSOR – SmartBio
Multichannel fluorescence & pattern recognition, Agents – Bacteria, bacterial spores, viruses, toxins

RADIOLOGICAL SENSOR – DELRAD
GM Tube, Agents – X Ray & Gamma Ray from 60 KeV to 2 MeV neutron dose

EXPLOSIVE DETECTOR – QS H150
Ion Mobility Spectrometer, Agents – Military, Commercial & Home-made explosives

Status – Undergoing Technical Trials at the Laboratory
SENSORS FOR DETECTION

CHEMICAL SENSOR – GID 3
Mass Spectrometry, Agents – GA, GB, GD, VX, HD and L

BIOLOGICAL SENSOR – SmartBio
Multichannel fluorescence & pattern recognition, Agents – Bacteria, bacterial spores, viruses, toxins

RADIOLOGICAL SENSOR – RADMAC
GM Tube, Agents – X Ray & Gamma Ray from 60 KeV to 2 MeV neutron dose

EXPLOSIVE DETECTOR – QS H150
Ion Mobility Spectrometer, Agents – Military, Commercial & Home-made explosives
CBRNe UAV *(Chemical, Biological, Radiological, Nuclear & Explosive)*

**SENSOR FOR DETECTION**

**DELRAD** – Defence Lab, Jodhpur

**Dose rate range**
For typical measurement (1mR/h to 1000R/h)
Gamma Ray Detection (100uR/h onwards)

**Power Requirement**
5V ± 0.2 V @ 25 mA

**Output**
RS 232 interface (TTL) (9600, N,8,1)

**Size** : 50x 45 x 27 mm³
**Weight** : ~ 40 g
**Temperature range** : -20 °C to +55 °C
Aim: To develop an tele-operated ROV for UXO detection, handling and defusal

Salient Features

Platform
Cross Country negotiating capability
Controls permitting conversion for remote driving
Existing platform to handle large loads

Water jet Cutting Machine
Cutting depth – up to 15mm steel

Communication
Range of Operation – 2 km LOS

Loader Arm
Lift capacity of 1000kg

Cutting Arm
Multiple axis configuration
Teach and playback operation

Status - Design Completed realization in progress
Abrasive Water Jet Cutting Machine
Projects in Pipeline
**Aim**: To develop a tele-operated ROV for IED handling and defusal in confined space

**SALIENT FEATURES**

- Range : 200m LOS
- Endurance : 2 hrs
- Manipulator reach 2 m vertical, 1m horizontal
- Degrees of Freedom : 05
- Payloads : Recoilless Water Jet Disrupters
- Aiming Devices : Lasers along with high resolution CCD Camera with 10X Optical zoom
- Command & Control : Remote through RF link
- Video : Real Time Transmission through RF link
- Vision : Multiple CCD cameras
- Master Control Station : Backpack based

**Status** - Design in progress
**Status** - Concept Prototype Realized

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**Video**
**SURVEILLANCE ROV**

**Aim**: To develop a portable tele-operated mini-ROV for Surveillance

**SALIENT FEATURES**

- Range : 200m LOS
- Endurance : 2 hrs
- Stair Climbing capability
- Silent Operations
- Payloads : Recoilless Water Jet Disrupters
- Aiming Devices : Lasers pointer
- Command & Control : Remote through RF link
- Video : Real Time Transmission through RF link
- Vision : Multiple CCD cameras
- Master Control Station : Hand held

**Status** - Prototype Design in progress
SURVEILLANCE ROV

Robotics Development Center, R&DE(Engrs), DRDO
**Aim**: To develop a weapon mounted ROV

**SALIENT FEATURES**

- Speed – 5kmph
- Endurance – 3 hours
- Range : 1 km
- Armaments
  - LMG – 7.62 caliber
  - Grenade Launcher 30mm caliber
- Safety features in-built
- E-Stop (Emergency Stop feature)
- Advance Vision Systems (Pan-o-Vision)
- Real-time Health Monitoring
  - Battery Status
  - Vehicle Pose
- Carrier Vehicle based MCS
  - Multiple Display based for Commander & Gunner

**Status**: Concept Prototype realized
**Status**  -  Concept Prototype Realized

[Video Clip]
ROV-’DAKSH’ - A Case Study

Date : 24 Jan 2013
Location : Changsari, Guwahati
ROV brought down on ramp and deployed to suspected site
ROV approaching suspected object
ROV aiming armament onto target
Suspected object neutralised
Suspected object detonator detached
Suspected object being extracted
BD personnel inspecting residuals
BD personnel inspecting residuals
Explosive presence confirmed
Internal contents of IED being inspected
Security personnel inspecting trigger circuit
UAV-’NETRA’ - A Case Study

Location: Junglechatti between Gaurikund to Rambara, Uttarakhand
Date: 22 to 25 Jun 2013
Role: Disaster Management
UAV – ‘Netra’ at Uttarakhand
UAV – ‘Netra’ at Uttarakhand
UAV – ‘Netra’ at Uttarakhand
UAV – ‘Netra’ at Uttarakhand
UAV – ‘Netra at Uttarakhand
....Thank You