BRIEF ON THE ONGOING RESEARCH AND DEVELOPMENT EFFORTS AT THE NIGERIA DEFENCE ACADEMY CENTRE FOR INNOVATION AND CREATIVITY (CINOCRE)

By

Lt Col AS IMAM
(Prof of Mechatronics & Robotics)

Head, Centre for Innovation and Creativity
Nigerian Defence Academy (NDA) Kaduna

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Introduction

Introduction

The Nigerian Defence Academy's Centre for Innovation and Creativity (CINOCRE), in partnership with ICE Technology Hub and StoneDoppa-87, has initiated a comprehensive series of Research, Development, and Innovation (RDI) projects.

- This collaborative effort aims to significantly boost the operational capabilities of the Nigerian Army (NA), focusing on improving efficiency and effectiveness in current operations.

- Through these strategic partnerships, CINOCRE leverages a blend of military insights and cutting-edge private sector technologies, ensuring that the NA is equipped with advanced solutions to meet the challenges of modern warfare.

Introduction

The collaboration between the trio has given rise to several ambitious RDI projects including:

- Stinger 1 (Chemical Weapon System).
- Stinger 2 (Proximity-based Rocket).
- Stinger 3 (Precision Guided Munition).
- Remotely Operated Weapon System.
- Regular 1 (Multi-Purpose Combat Mobile Robot).
- Mortar Illumination Round.
- Claymore Directional Mine.

- The execution of these projects is strategically distributed across 2 key locations the NDA CINOCRE at the NDA Old Site and ICE Technology Hub facilities in Rigachikun, directly opposite the CED, to leverage specialised resources and expertise available in the 2 locations.

Introduction

This dual-location approach not only facilitates the optimal utilization of each facility's unique capabilities but also fosters a collaborative environment that is essential for the innovative and technical advancement of the projects.

Collective Aim of the Projects

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- The collective aim of these projects is to equip the NA with advanced technological solutions that can significantly enhance its operational capabilities.

- This includes increasing the accuracy and efficiency **of target engagement**, **improving night operations**, **ensuring the safety** of both **personnel** and **civilians** and providing non-lethal incapacitation options.

- Each project is designed to address specific tactical needs, contributing to a comprehensive enhancement of the NA's overall combat readiness and operational effectiveness.

Brief's Aim

Brief's Aim

- This brief aims to give an update on the NDA CINOCRE's RDI efforts.

Projects Overview

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- Stinger 1 (Incapacitating Chemical Agent).
- Stinger 2 (Proximity-based Rocket).
- Stinger 3 (Precision Guided Munition).
- Remotely Operated Weapon System.
- Regular 1 (Multi-Purpose Combat Mobile Robot).
- Mortar Illumination Round.
- Claymore Directional Mine.

STINGER 1 Project

1. **Stinger 1 RDI (Biological Weapon):** To pioneer a humane, chemical -based weapon system capable of incapacitating or immobilizing enemy forces with precision.

2. **STINGER 2 (75 mm Proximity-Based Rocket):** To create a rocket system that combines precision targeting with minimal collateral damage, offering strategic advantages in threat neutralization.

3. **STINGER 3 (Precision Guided Munition):** To enhance strike capabilities with munitions that can be accurately guided to targets, ensuring high effectiveness in neutralizing threats.

STINGER 1 Project

1. **Remotely Operated Weapon System:** To develop a system that allows for precise, remote engagement of targets, enhancing force protection and operational versatility.
2. **Multi-Purpose Combat Mobile Robot:** To develop an autonomous robot capable of performing a variety of battlefield functions, from reconnaissance to direct combat engagement.
3. **Claymore Directional Mine:** To innovate in the design and deployment of the Claymore mine for improved effectiveness and safety in area denial and perimeter defence.
4. **Mortar Illumination Round:** To develop mortar rounds that provide superior illumination for extended periods, enhancing night operation capabilities.

STINGER 1 Project

- The STINGER 1, 2 and 3 projects began in February 2023 after the Second Quarter of the NA R&D Focal Point Officers' (FPO) meeting.

- AHQ DATI provided the initial funding of **Three Million (N3,000,000)** for the RDI involving Stinger 1 and 2 (Rockets, PGM and Biological Weapon) .

Later, AHQ approved an additional sum of **Seven Million Naira (N7,000,000)** towards the RDI's execution. Equally, 2 Toyota Hilux vehicles were provided to facilitate the testing of the RDIs prototypes.

Methodology

Methodology

- The projects shared the same methodology for achieving them, which involves a structured, multi-phased approach that ensures thorough development, testing, and implementation of each technological solution.

- The general methodology includes :

1. **Needs Assessment and Feasibility Study Objective:** Identification of specific operational challenges and requirements of the NA. Activities here include conducting interviews and reviewing existing technologies and their limitations.
2. **Conceptualization and Design Objective:** Development of innovative concepts and designs that meet identified needs. Activities include utilizing multidisciplinary teams to brainstorm and design prototypes.

Methodology

3. Research and Development (R&D) Objective: Transforming conceptual designs into functional prototypes. Activities here include conducting rigorous research on materials, technologies, and methodologies.

4. Testing and Evaluation Objective: Assess the effectiveness, safety, and reliability of prototypes in simulated and real-world scenarios. Activities here include controlled laboratory tests followed by field trials, gathering data on performance, usability, and any potential issues.

5. Iteration and Optimization Objective: Refine prototypes based on feedback from testing and evaluation. Activities here include analyzing test results to identify areas for improvement.

Methodology

6. Integration and Operational Testing Objective: Ensuring that the technology integrates seamlessly with existing NA systems and meets operational requirements. **Activities here include** conducting operational testing with actual NA units (in-theatre) to evaluate system performance in operational environments, ensuring compatibility with existing protocols and systems.

7. Training and Documentation Objective: Prepare the NA personnel for effective utilization of the new technologies. **Activities here include**: Developing comprehensive training programmes and documentation, including manuals and instructional videos, to ensure proper operation and maintenance of the technologies.

Methodology

8. Deployment and Implementation Objective: Officially deploy the technology for active operational use. Activities: Gradually integrate the new systems into active duty, monitoring their use and effectiveness in real operations.

9. Continuous Monitoring and Support Objective: Provide ongoing support and updates to ensure the long-term success and relevance of the technologies. Activities: Establish a feedback loop with end-users for continuous improvement, and provide maintenance and updates as necessary.

10. Review and Future Development Objective: Assess the impact of the technologies on operational effectiveness and identify areas for future research and development. Activities: Conduct post-implementation reviews, document lessons learned, and use this insight to inform future innovation projects.

Results

STINGER 1 - Results

- STINGER 1 incorporate chemical agents capable of temporarily incapacitating or immobilizing humans.

- It contained BZ (3-quinuclidinyl benzilate), a psychoactive chemical that interferes with cognitive functions, causing confusion, hallucinations, and inability to perform combat tasks.

- Qty 2 of STINGER 1 prototypes have been produced and are ready for field test.

STINGER 2

STINGER 2 - Results

- STINGER 2 is a 75-Rocket and its MBRL represents advanced military hardware for counter-insurgency operations.

- It is an unguided **75 mm** solid fuel rocket, measures 1.6 m in length, weighs **36 kg**, and carries an **18.4 kg** warhead, with a range of **10-15 km**.

- It can be launched from both single-tube and multi-barrel (MBRL) platforms.

STINGER 2 - Results

- The MBRL system is capable of:
  - Firing up to 36 rockets in 30 seconds over 2-15 km.
  - Target areas up to 500 metres square with a variety of munition types, from high-explosive to incendiary, ensuring versatile and significant firepower from a mobile platform.
- The impact of these rockets can create a significant fragmentation or blast effect.
- Qty 6 of STINGER 2 have been built, and 3 have been test-fired.

STINGER 3

STINGER 3 - Results

The STINGER 3 is a 100 mm Precision Guided Munition (PGM) designed for high-precision strikes with minimal collateral damage, enhancing lethality against specific targets.

STINGER 2 features specifications including a length of **1.6 m**, a weight of **25 kg**, and a diameter of **100 mm**.

STINGER 3 - Results

- The Vehicle Mounted Missile Launcher (VMML) serves as the launch and storage platform, offering rapid deployment, reliability, and safety for the PGM.

- It can accommodate 6 units of the PGMs, launching them one at a time from military Medium Tactical Vehicles.

- Two units of STINGER 3 prototypes have been built to 75 per cent completion, however, no field trials have been conducted.

ROWS

ROWS - Results

- The Remote Operated Weapon System (ROWS) is a versatile and advanced weaponry platform that can be integrated onto a variety of platforms including armoured vehicles, gun trucks, static observation towers, unmanned ground vehicles (UGVs), and ships.

- The ROWS enables operators to control weapon systems remotely, enhancing personnel safety by allowing them to remain under cover while engaging targets.

ROWS - Results

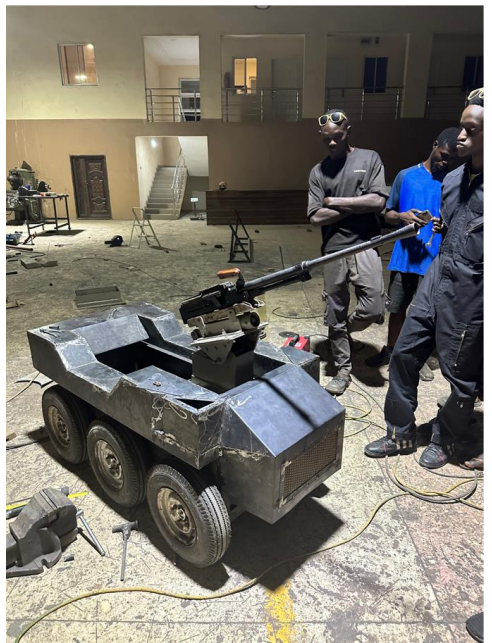
- It features include:
  - **Thermal Camera:** Making it possible to operate effectively under low visibility conditions, including night operations and through smoke or foliage.
  - **Optical Camera:** Provides high-resolution imagery for target identification and engagement during daylight.
  - **Joystick:** Offers intuitive control over the weapon system's aiming and firing mechanisms, allowing operators to manoeuvre and engage targets with precision.
  - **Viewing Screen:** Displays real-time video feeds from thermal and optical cameras, enabling operators to monitor the battlefield, identify targets, and make informed decisions from a safe distance.

Project REGULAR

Project REGULAR - Results

- Under the strategic directive of COTI, the REGULAR project commenced on 22 Oct 23 aimed at developing a robotic platform Inspired by the Jaguar model.

- REGULAR is designed to be a semi-autonomous system with the potential to revolutionize NA's contemporary operations through its advanced features.



Project REGULAR - Results

- It features:
  - It could accommodate various weapon types including all categories of machine guns, QJC and AA gun.
  - It is capable of firing both stationary and in motion.
  - It is equipped with a high-resolution electro-optical and thermal camera for surveillance.
  - It is also equipped with a long-range transceiver, headlights, and a remote-controlled public address system.

Project REGULAR - Results

- It features:
  - It is Integrated with multiple sensors including GPS, Ultrasonic, and Accelerometer for enhanced navigation and situational awareness.
  - It is capable of automated driving and self-destruct capabilities for operational security.
  - It could incorporated with navigation sensors to facilitate autonomous navigation and real-time situational awareness.
  - One unit of the REGULAR has been built and has undergone several field trials.

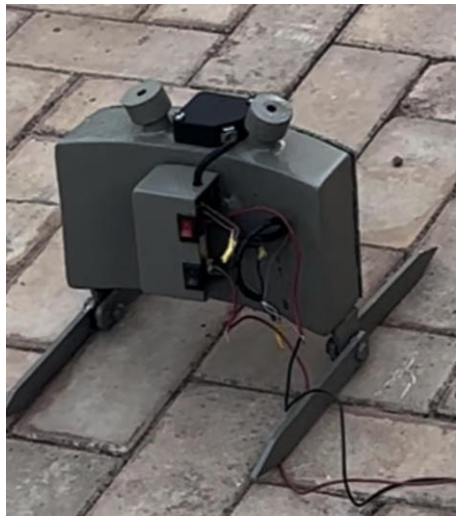
Claymore Directional Mine.

Claymore Mine- Results

Our Claymore mine is a directional fragmentation anti-personnel mine, specifically designed for ambushes and defensive positions.

- It is capable of projecting a fan-shaped pattern of steel balls or shrapnel towards the enemy when detonated, effectively causing injury or death within a specified area.

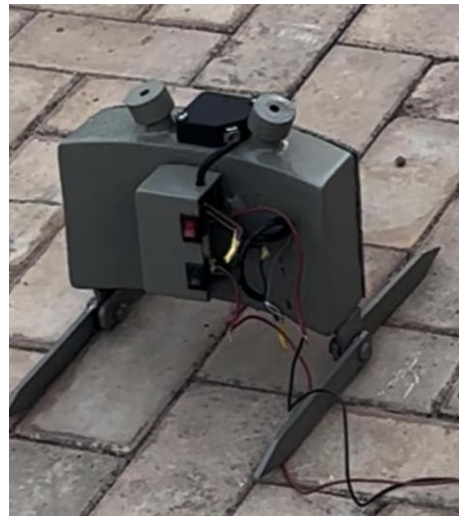
- The design and operational features of the Claymore mine are as follows:
  - **Shape and Size:** Curved, rectangular shape measuring approximately 216 mm in width, 38 mm in depth, and 89 mm in height, with a weight of around 2 kg.



Claymore Mine- Results

The design and operational features of the Claymore mine are as follows:

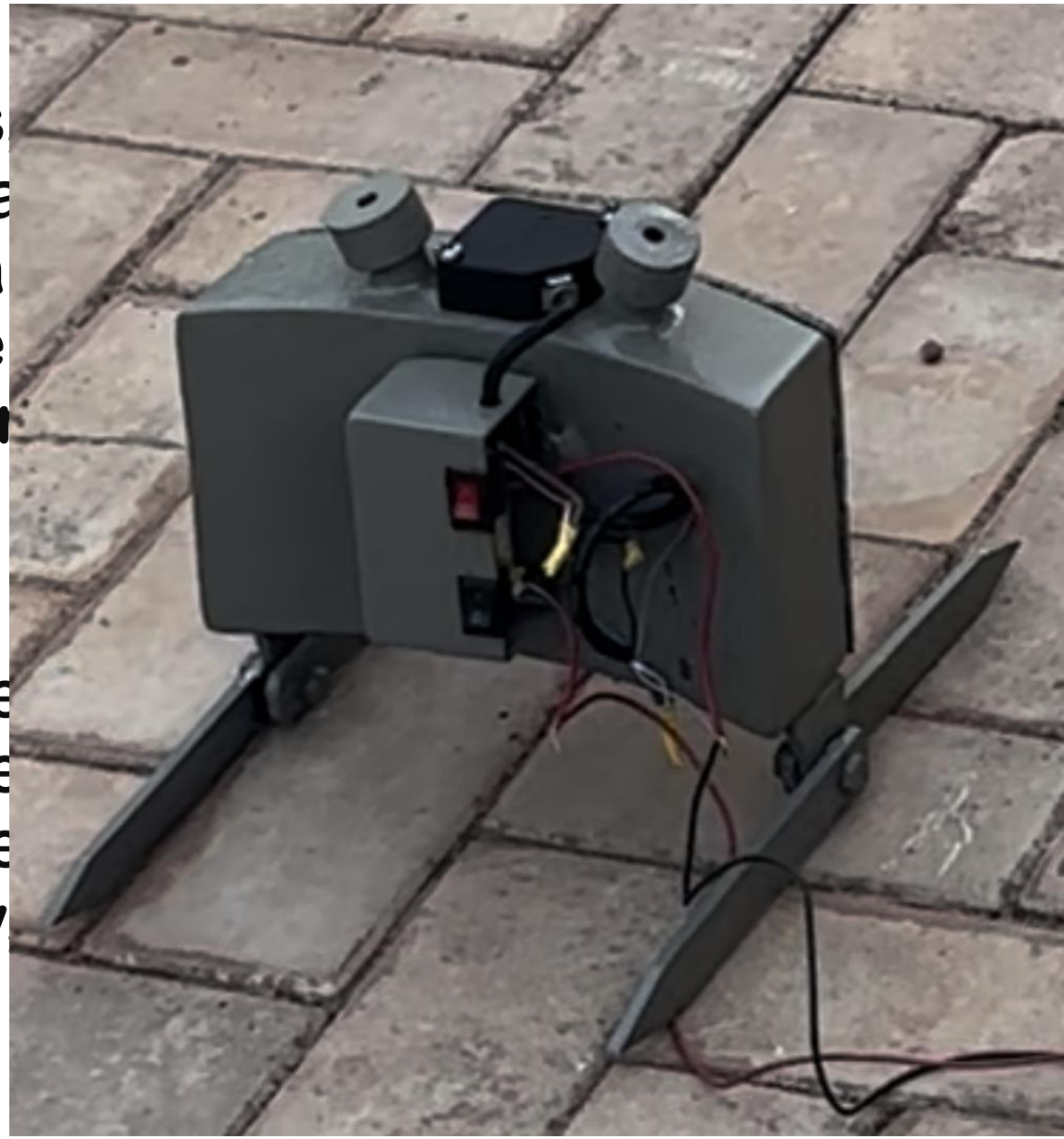
- **Housing:** Constructed with an 8 mm thick steel rear and a 1.5 mm light front plate, facilitating the discharge of steel balls and explosive components.
- **Explosive Charge:** A potent mix of Potassium Chlorate (65%), Iron (III) Oxide (10%), Aluminium powder 100microns (German Dark) (20%), and Sulphur (5%), achieving a burn rate of 31ft/sec and an explosive velocity estimated at 29,000ft/sec.
- **Ball Bearings/Shrapnel:** Packed with 900 pieces of 6.5 mm steel balls, designed to spread upon detonation, ensuring a wide arc of lethality. e.
- **Detonation Mechanisms:** Flexible detonation methods including sensors, electrical firing devices, a tripwire, or remote control, enhance tactical deployment versatility.
- Safety Features: Incorporated with a safety switch to prevent accidental detonation.



Claymore Mine- Results

- **Tactics:** Often used for ambushes, perimeter defence, or to cover a retreat, the Claymore's directiona blast allows troops to channe enemies into specific areas or prevent them from advancing.

- **Advantages Directional Blast:** The mine's design ensures that the explosive force and shrapnel are directed towards the enemy, minimizing unintended casualties.



Mortar Illumination Round

Challenges

Challenges

- While undertaking the projects, we encountered several challenges including:

Funding and Resource Allocation Challenge: Securing adequate funding and resources for RDI projects can be a significant hurdle. High-tech defence projects require substantial investments in materials, technology, and skilled personnel.

Impact: It caused delays in the project timelines, reduced the scope of research, or even halted some aspects of the projects entirely.

- **Technological Complexities Challenge:** The development of cutting-edge technologies, especially in defence, involves complex engineering and scientific research. This can include the integration of new materials, software, and electronics.
  - **Impact:** Technological hurdles can lead to setbacks, requiring additional time for problem-solving and innovation.

Challenges

- **3. Collaboration and Coordination Challenge:** The projects often require collaboration between various departments, units, formations HQs and external agencies. Coordinating these efforts effectively can be challenging.
  - **Impact:** Misalignment and communication gaps can impede project progress and lead to inefficiencies and delays.

- **4. Regulatory and Ethical Considerations Challenge:** Defence-related RDI projects faced stringent regulatory, legal, and ethical considerations, particularly when dealing with weapons systems and advanced military technologies.
  - **Impact:** Compliance issues can delay project execution and, in some cases, limit the scope of research and development activities.

Challenges

5. Talent Acquisition and Retention Challenge: Attracting and retaining highly skilled personnel in various specialized fields is essential for the success of RDI projects.

- **Impact:** Skill gaps and high turnover rates can slow down project momentum and affect the quality of innovation.

6. Testing and Validation Challenge: Extensively testing and validating new technologies, especially those intended for military applications, can be time-consuming and resource-intensive.

- **Impact:** Delays in testing phases can postpone project completion and operational deployment.

- Addressing these issues would enhance our team's ability to successfully deliver on its RDI projects, thereby contributing significantly to the operational effectiveness and technological advancement of the Nigerian Army.

Conclusion

Conclusion

- The RDI projects embarked upon by the Centre for Innovation and Creativity (CINOCRE), including STINGER 1, STINGER 2, STINGER 3, the Remote Operated Weapon System (ROWS), and the Multipurpose Combat Mobile Robot, represent a significant leap forward in enhancing the operational effectiveness of the NA.

- These initiatives reflect a comprehensive approach to modernizing and equipping the NA with advanced technological capabilities, ranging from precision-guided munitions and autonomous systems to innovative weapon platforms and robotics.

- The methodology adopted for the successful execution of the RDI projects involves a systematic, phased approach that encompasses conceptualization, design, development, testing, and deployment, ensuring that each project is rigorously evaluated for feasibility, effectiveness, and operational integration.

Conclusion

- The RDI face significant challenges, including the need for sustained funding and the management of complex technical development processes that require specialized knowledge and skills.

- Additionally, overcoming the regulatory and ethical considerations inherent in defence technology R&D, ensuring the security of sensitive information, and maintaining pace with rapid technological advancements present ongoing hurdles.

- Overcoming these challenges necessitates a strategic approach that includes securing diversified funding sources, fostering a culture of innovation and collaboration, investing in talent development, and implementing robust security and ethical standards.

Recommendations

Recommendations

- To ensure the successful implementation and maximization of benefits from the RDI projects spear-headed by NDA CINOCRE, the NA through AHQ DATI should:

1. Strengthen funding and resource allocation.
2. Enhance collaboration by building strategic alliances with research institutions, defence contractors, and international defence technology firms to share knowledge, resources, and best practices.
3. Create an environment that rewards creativity and risk-taking among researchers and developers.
4. Invest in talent development and develop specialized training programmes for personnel involved in RDI:
5. Attract and retain talent by offering competitive compensation, career development opportunities, and a stimulating work environment to attract and retain skilled professionals.
6. Adopt a phased approach to development by Breaking down complex projects into manageable phases with specific milestones to monitor progress effectively.
7. Leverage cutting-edge technologies: Stay abreast of emerging technologies that can be incorporated into defence projects to enhance capabilities.
8. Ensure comprehensive testing of technologies in a variety of operational conditions to validate performance and reliability.

Thank you