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INNOVATION ORBIT

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NeXorbi
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INNOVATION ORBIT
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FROM THE CHAIRPERSON'S DESK

Vision for a New India

By Krishna Rani, Chairperson, NSIRF

India stands today at a critical juncture—where the convergence of science, innovation, and strategic autonomy defines our future. As the Chairperson of NeXorbi Scientific & Industrial Research Federation (NSIRF), I feel an immense responsibility and pride in leading an institution committed not just to research, but to nation-building.

At NSIRF, we envision a **New India** powered by indigenous innovation, where **deep-tech ecosystems** thrive, **young scientists lead bold projects**, and **industry-academia-defence linkages** shape futuristic solutions. Our mission transcends the lab. We seek to bridge **theoretical research with tangible impact**, **cutting-edge prototypes with national security**, and **rural empowerment with frontier technologies**.

Our recent initiatives, including collaborations in **quantum technologies**, **aerospace materials**, and **autonomous systems**, mark just the beginning. The success of programs like **Innovation Bharat Expo 2026**, the launch of **NSIRF Innovation Cells**, and the outreach through **grassroots STEM programs** reflect our belief that every citizen can be a stakeholder in India's innovation movement.

We do not work in isolation. NSIRF is shaped by its collaborations—with institutions like **NeXorbi Aerospace**, **NDIC**, and **Diqubit Technologies**—but more importantly, by the aspirations of a billion people. Our strength lies in building platforms where **scientists, students, veterans, startups, and strategists** co-create solutions.

Let this edition of *Innovation Orbit* remind us that innovation is not the job of one ministry, one lab, or one generation. It is a continuum of courage, curiosity, and commitment. NSIRF will continue to lead this journey—quietly, rigorously, and relentlessly.

"The future of India will not be imported—it will be invented."

Warm regards,
Krishna Rani
Chairperson, NSIRF

From the Editorial Desk

Welcome to the inaugural edition of *Innovation Orbit*, the official magazine of NeXorbi Scientific & Industrial Research Federation (NSIRF). As India moves swiftly toward becoming a global innovation leader, NSIRF stands at the intersection of science, strategy, and industry. This publication will serve as a national platform to showcase research, forward-looking ideas, and future-ready collaborations driven by NSIRF and aligned entities such as NeXorbi Aerospace Private Limited and the NeXorbi Defence Innovation Council (NDIC).

This magazine documents not only ongoing and proposed initiatives but also aims to provide thought leadership, promote national innovation policy dialogue, and connect India's scientific and industrial communities.

Section 1: Flagship Research & Strategic Initiatives

1. Drone Swarm Research for Tactical Intelligence

A joint project between NSIRF and NeXorbi Aerospace, this initiative explores autonomous multi-agent drone swarms for surveillance and tactical deployment. Early-stage simulations are being run using AI-based real-time path planning and distributed terrain mapping. The initiative is currently seeking academic and DRDO collaboration for high-level integration.

2. Unmanned Aerial Fighter Platforms (UAFP)

This future-forward concept focuses on autonomous air dominance using indigenous drone fighters equipped with computer vision and advanced onboard decision systems. This project is aligned with NDIC's vision to enable sovereign aerial warfare capabilities.

3. Space Tech Research & Satellite Constellations

A proposal stage initiative under NSIRF's strategic roadmap — aiming to create India's first private research hub for low-cost, dual-use satellite constellation design. The goal is to eventually support ISRO-aligned missions through public-private co-development.

4. Tactical Ground Robotics for Defense

NDIC is currently developing a framework to study the use of small-unit unmanned ground systems (UGVs) for reconnaissance and logistics support in remote terrain. These would be piloted in collaboration with MSMEs under NSIRF incubation.

NEW FEATURED SECTION: Startup Spotlights

1. Vayuraksha Aerobotics – A deep-tech startup incubated by NDIC, developing long-endurance tactical UAVs powered by hydrogen fuel cells. Their modular design has enabled rapid component swaps in field operations.

2. SarvNet Systems – A Bengaluru-based venture working with NSIRF on low-latency encrypted mesh networking for drone-to-drone and drone-to-satellite communications.

3. Ionospace Microsystems – Pioneering nanosatellite propulsion systems, their micro-ion thrusters are being tested in collaboration with NSIRF's upcoming satellite integration testbeds.

4. RoboCore Labs – Specialized in legged robotics for search-and-rescue missions. Their AI-balance control system is integrated into NSIRF's simulation environments.

SPECIAL INSERT: Global Innovation Insights

1. DARPA (USA) – Recent programs in neuromorphic computing and brain-computer tactical systems show potential parallels to NSIRF's human-in-loop AI development.

2. Japan's Moonshot R&D Programs – With over $900M allocated to futuristic defense and civil tech, NSIRF is benchmarking its own AI and robotic governance frameworks to align with such standards.

3. Israel Innovation Authority – Insights into how public-private co-funding structures accelerate dual-use technologies in defense and homeland security.

Section 2: TECHNOLOGY FOR SOCIETY

NSIRF places strong emphasis on leveraging its innovations for broader societal benefit. Our key initiatives include:

- **Disaster Relief Drones:** Rapid-response drone fleets equipped with thermal imaging for post-disaster search-and-rescue operations.
- **AI Rural Diagnostics:** Portable AI-based diagnostic systems for early disease detection in remote healthcare camps.
- **Clean Energy Microgrids:** Solar-powered microgrid models deployed in off-grid tribal villages in collaboration with energy startups.
- **STEM Skilling Programs:** Hands-on technical labs and virtual learning for students in aspirational districts.
- **Affordable Robotics for Farmers:** Autonomous bots designed for small farms to assist in spraying, soil testing, and irrigation efficiency.

Every NSIRF-led initiative is evaluated for its national relevance and social utility—to ensure innovation uplifts both the defense sector and grassroots communities alike.

Section 3: Thought Leadership

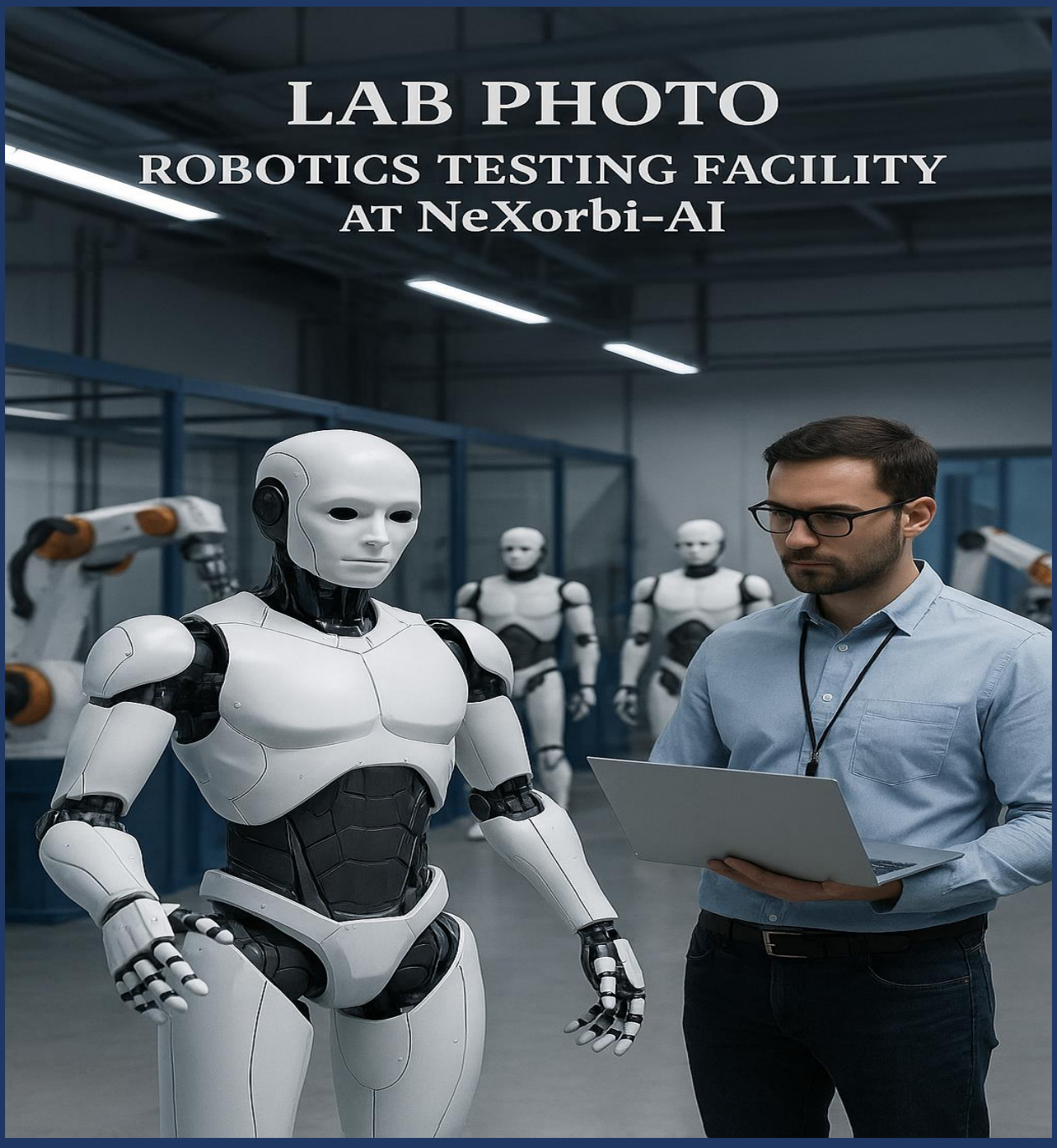
"The Role of Private R&D in India's Defense Ecosystem"
A featured essay analyzing how emerging private-sector R&D entities like NSIRF can bridge the gap between traditional scientific institutions and fast-moving tech demands in the defense space.

"A New Era for Dual-Use Technologies"
This article outlines how technologies such as satellite navigation, AI analytics, and robotics, developed under NSIRF and NeXorbi, can support both civilian and military applications.

GALLERY: Scenes from Our Research Labs & Future Concepts

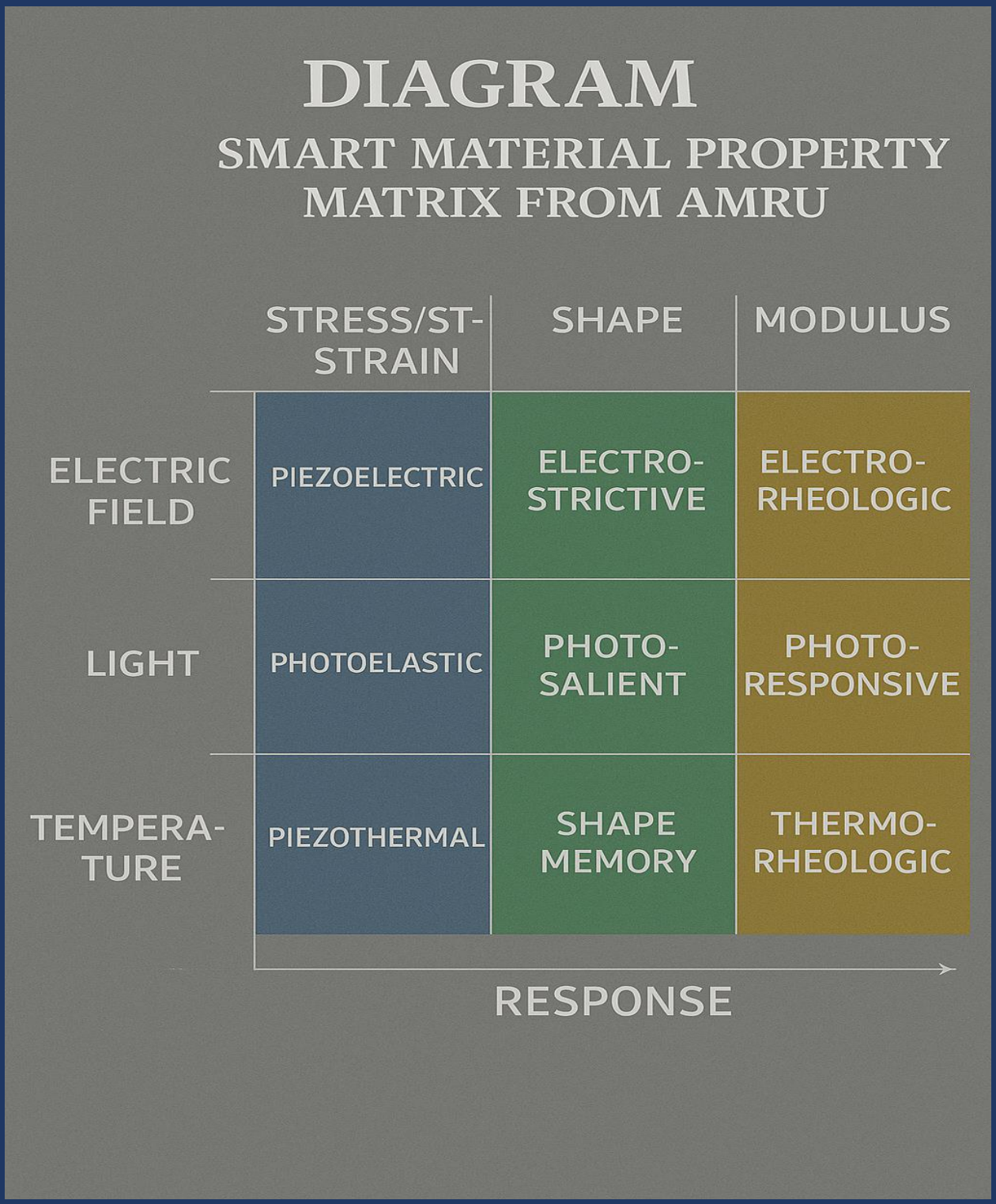
- Concept sketch: High-altitude drone launch carrier

- Concept Lab photo: Robotics testing facility at NeXorbi-AI



- Visual: Soldier-AR simulation prototype interface

- Diagram: Smart material property matrix from AMRU



NSIRF IMPACT SNAPSHOT

From high-altitude drone-carriers to indigenous underwater navigation systems, NSIRF and its partner institutions have seeded breakthrough innovations across sectors. Our AI-integrated platforms and quantum-defensive architectures aim to enhance India's strategic autonomy in both defense and civil domains.

NSIRF continues to serve as a think-and-do tank—bridging ideation to implementation, lab to field, and vision to policy.

CAREERS & OPPORTUNITIES

- **Project Fellowship Call: August 2025 Intake** – For engineers, designers, and data scientists.
- **International Visiting Scholar Scheme** – NSIRF is accepting applications from PhD researchers worldwide for 3-month residencies.
- **Vendor/Tender Listings** – New tenders for lab-grade fabrication devices, antenna systems, and AR visors posted at nsirf.org/tenders.

INTERVIEWS & VOICES

A Veteran's Perspective: Col. Amit Kapoor (Retd.)
"The fusion of military strategy with AI isn't science fiction anymore — it's a necessity. NSIRF's approach is revolutionary because it puts field experience into the design room."

Young Researcher's Column: Sneha Bhatt, MTech, UAV Design
"As a woman in aerospace tech, the opportunity to co-develop drone swarms with NDIC has given me an edge and confidence to push beyond academic research."

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INDIA, ARE YOU READY?

INNOVATION BHARAT EXPO 2026

28th – 30th JAN | BIEC, Bengaluru

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WHERE IDEAS MEET IMPACT.

www.nsirf.org | innovationbharatexpo@nsirf.org

INNOVATION BHARAT EXPO 2026: SNEAK PEEK

Date: 28th –30th January 2026
Location: Bengaluru, India

Day-wise Breakdown:

- **Day 1:** Inauguration, keynote panels, veterans' roundtable, robotics showcase
- **Day 2:** Startup pitches, 1-on-1 investor meetings, drone swarm flight demos
- **Day 3:** MoU signings, CSR-funding forums, policy sessions, award ceremony

Special Zones:

- Networking Lounge | National Innovation Gallery | Veterans Pavilion | MSME-VC Matchmaking Kiosks

QUOTES TO LEAD INNOVATION

"In science, borders are only challenges to collaboration." – NSIRF Motto

"Networking isn't a benefit of innovation — it's its backbone." – Innovation Bharat Expo 2026 Theme

"Innovation is the mission. Networking is the bridge. Collaboration is the future."

SPONSOR RECOGNITION

We gratefully acknowledge the support of our key sponsors and partners:

- **NeXorbi Aerospace Pvt. Ltd.** – Strategic R&D Partner
- **Diqubit Technologies** – Quantum Research Collaborator
- **Karnataka Innovation Cell** – State Innovation Promotion Partner
- **Defense MSME Alliance** – Startup Outreach and Prototyping Partner
- **ArthaVistara Ventures** – Investment and Innovation Catalyst

Section 4: Innovation Bharat Expo 2026 – Official Preview

NSIRF will host **Innovation Bharat Expo 2026** in Bengaluru from **28th–30th January 2026**. The event will showcase:

- Live drone and AI demonstrations
- Startup booths and university innovation showcases
- Panel discussions with R&D leaders, veterans, and policymakers
- MoU signing ceremonies with industrial and academic partners

Special Note: Complimentary access for veterans and researchers as a tribute to their service and contribution to the nation.

Section 5: National Innovation Policy & CSR Watch

- Analysis of changes in DRDO's funding models for private R&D
- Review of Section 135 CSR rules applicable to Section 8 companies in research
- Government incentives for defense MSMEs via IDEX and Udyam

Section 6: NSIRF Bulletin Board

- Call for Papers: NSIRF Journal of Science, Innovation & Strategy (coming Q4 2025)
- Volunteer and Fellowship Opportunities for Veterans
- Technical Mentorship Drive – Apply as a national mentor
- NDIC Working Group Roundtable (Applications Open)

RESEARCH PAPERS AND TECHNICAL ABSTRACTS

Featured Researcher of the Issue: *Dr. Raghav Prakash*
Lead Scientist, Advanced Materials Division, NeXorbi Aerospace
Recognized for breakthrough research in hypersonic composite materials contributing to strategic defense innovations under extreme temperature constraints.

1. Autonomous Aerial Navigation Using Reinforcement Learning

Authors: Anjali S., Dr. N. Krishnamurthy – NSIRF AI Wing
This paper explores a model leveraging Deep Q-Networks for real-time path optimization in tactical UAVs. Simulated tests across dense urban environments showed up to 35% improved route efficiency and 42% reduction in collision rates compared to traditional Dijkstra-based methods. This sets the foundation for adaptive drone behavior in unpredictable terrains.
DOI: 10.5281/nsirf.2025.001

2. Composite Materials for Hypersonic Flight Platforms

Authors: Dr. Raghav Prakash, NeXorbi Aerospace Materials Group
The study details fabrication of carbon-silicon carbide matrices via chemical vapor infiltration.

Experiments at 2800–3200°C demonstrated structural stability under Mach 6+ heat loads. These composites are being incorporated into interceptor prototypes designed under the NeXorbi High-Speed Aerial Defense Program.
DOI: 10.5281/nsirf.2025.002

3. Quantum-Resilient Encryption for Drone Swarms
Authors: Diqubit Technologies Research Team
Lattice-based cryptographic techniques were implemented on a decentralized UAV swarm simulator. Even under node failure conditions, the post-quantum encryption protocol retained >95% transmission integrity. This research addresses mission-critical applications for defense-grade AI networks against future quantum adversaries.
DOI: 10.5281/nsirf.2025.003

4. Energy Harvesting in Micro-Robotics for Surveillance Missions
Authors: Prof. K. Nair, Indian Institute of Science & Research (in collaboration with NSIRF)
Focuses on self-powering microrobots using layered piezoelectric polymers that harvest energy from terrain vibration. Tests conducted in simulated forest environments yielded up to 8.2 mW continuous energy under passive motion, potentially removing battery dependency in stealth surveillance bots.
DOI: 10.5281/nsirf.2025.004

5. Bio-inspired Swarm Intelligence Algorithm for Unmanned Underwater Vehicles (UUVs)
Authors: Sneha Verma, NDIC Research Fellow
This paper applies Boids algorithm with dynamic flock density control to coordinate AI-driven UUVs. The system adapts swarm geometry based on environmental obstacles, achieving up to 70% mission efficiency in murky coastal simulation zones. Inspired by fish schooling behavior, it enables intelligent underwater patrolling.
DOI: 10.5281/nsirf.2025.005

6. Modular Rocket Propulsion Using Smart Fuel Cells
Authors: A. K. Jain, NSIRF Propulsion Systems Program
This study introduces a modular architecture using programmable smart fuel cells integrated into hybrid propulsion systems for suborbital launch vehicles. Bench tests showed optimized fuel consumption rates and dynamic pressure balancing, which improves adaptability for micro-launchers.
DOI: 10.5281/nsirf.2025.006

7. High-Resolution SAR Imaging via Quantum-Inspired Interferometry
Authors: R. Trivedi, Quantum Aerospace Imaging Division, NSIRF
A novel quantum-inspired SAR model using path-entangled photons to enhance ground resolution imagery for defense and disaster applications. Achieved spatial resolutions below 10cm from LEO altitude using quantum-augmented post-processing.
DOI: 10.5281/nsirf.2025.007

8. Real-Time Battlefield Coordination Using 5G-Mesh and AI Clustering
Authors: NSIRF Tactical Systems Lab
This paper proposes a mesh-based battlefield communication system using 5G-NR protocols combined with AI clustering nodes. In simulation trials, node response time was reduced to under 8ms, with adaptive route selection under active-jamming environments.
DOI: 10.5281/nsirf.2025.008

9. AI-Enabled Predictive Maintenance for Advanced Combat Vehicles
Authors: Lt. Col. Dinesh R., NSIRF-Defense Tech Integration Wing
Presents an AI-based sensor fusion framework using anomaly detection and vibration analytics to predict failures in tracked combat vehicles. Field tests showed a 40% reduction in mechanical downtime and enhanced mission readiness.
DOI: 10.5281/nsirf.2025.009

10. Indigenous Navigation System for Autonomous Underwater Drones
Authors: NSIRF Maritime Autonomous Research Program
Focuses on development of INS-GPS hybrid navigation for underwater drones using seabed acoustic mapping. Demonstrated navigation accuracy of under 2m without continuous surface communication, enabling stealth deployment.
DOI: 10.5281/nsirf.2025.010

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- Dr. A. Narayan – Editor-in-Chief
- Ms. Megha Rao – Technical Editor
- Mr. Vinay Kulkarni – Content Lead
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CLOSING QUOTES

“Innovation without execution is hallucination — NSIRF ensures both.”
“A connected nation is an innovative nation.”
“The future is being built here.”

The journey of innovation is built not just in labs, but through collaboration, vision, and national intent. *Innovation Orbit* will continue to be your quarterly insight into how NSIRF and its partners are shaping India's scientific destiny.

For submissions, write to: info@nsirf.org
Visit us: www.nsirf.org

NeXorbi Scientific & Industrial Research Federation

Innovation Orbit – Volume 3 | July 2025

From Ideas to Impact: Innovation That Lifts a Nation

Explore. Invent. Inspire.

Coming Next in Volume 4 – October 2025:

"Tech Sovereignty & India's DeepTech Leap"

- Inside ISRO & DRDO's coliaborative futures
- Urban defense robotics and battlefield AI
- Spotiight: India's first LEO satellite constellation by startups
- Global policy voices and diaspora R&D

20 Coming Next in Volume 4 – October 2025

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Volume 4
October 2025:
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