

4IR Technologies:
**AI, Autonomous
systems, Robotics**

Emirate:
Abu Dhabi

Maturity:
■ ■ ■ ■ □
Operational Deployment

Type:
Public

MANUFACTURING

007 Applied R&D Platform for Autonomous Robotics Systems

ACTORS

**Advanced Technology Research Council
Technology Innovation Institute**

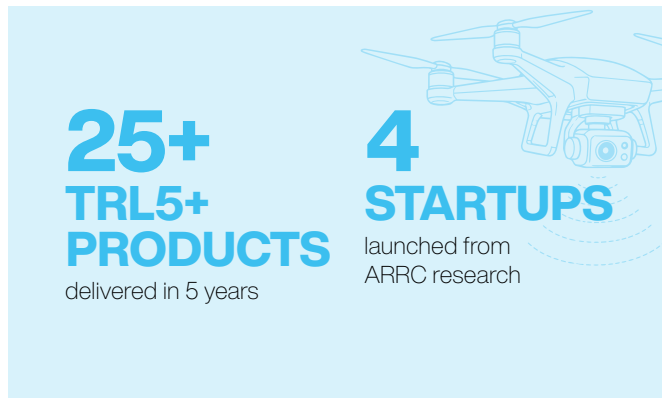
SNAPSHOT

The Autonomous Robotics Research Center (ARRC) is one of the nine research centres within the Technology Innovation Institute (TII), which is Abu Dhabi's applied research arm, operating under the Advanced Technology Research Council (ATRC). Founded in 2020 and headquartered in Masdar City, TII is now home for more than 1,000 researchers and engineers, delivering R&D products in the form of client proof-of-concepts that respond to societal and industrial needs. In 5 years, ARRC has delivered more than 25 TRL5+ products, launched four startups, and partnered with international R&D institutions, such as Caltech for advanced research on aerial robots, and NVIDIA to launch the Middle East's first joint AI and robotics research lab.^{1,2}

WHY IT MATTERS

As with the other centres in TII, ARRC helps the UAE move from being primarily a buyer of advanced technology to becoming a creator, owner, and exporter of it. That shift requires the applied research infrastructure behind such technologies: the labs, the talent, the computing power, the testing facilities, and the institutional capacity to move from scientific breakthrough to deployable technology.³

ARRC develops the core capabilities that make machines genuinely autonomous: perception and computer vision, communications, navigation and control, AI-based decision-making, and swarm coordination. Its systems are designed to work across air, land, surface-water, and underwater environments, including difficult settings where localisation systems, communications and human infrastructure may be unavailable. ARRC describes applications ranging from search and rescue and environmental monitoring to mapping, oil-spill response, and ecosystem restoration.⁴



HOW THE TECHNOLOGY WORKS

One of the technologies emanating from ARRC gave rise to the startup SIRBAI. The main product of SIRBAI is the software framework that enables multiple autonomous robots to operate as a coordinated team. The platform combines aerial, ground, surface, or underwater vehicles with distributed AI, onboard sensing, robot-to-robot communications, and adaptive mission-planning software.^{5,6}

A human operator begins by defining the mission objective, operating area, priorities, and safety constraints. SIRBAI then distributes the work among the available robots. Instead of remotely piloting every robot, the operator supervises the overall mission while each robot performs its tasks and makes decisions locally.⁷

Each robot uses cameras and other sensors to perceive its surroundings, estimate its position, collect mission data, and act within the environment. Onboard edge computing allows it to process this information without continuously sending everything to a central server.⁸

SIRBAI's main purpose is to test such behaviour under controlled but realistic conditions. Researchers can repeatedly introduce communication failures, inaccessible areas, changing priorities, obstacles, or robot malfunctions and observe whether the swarm continues performing its mission.⁹

In simple terms, SIRBAI works by shifting robotic operations from "one person controlling one machine" to "one person supervising an intelligent, self-coordinating team." Its value lies in demonstrating that a swarm can remain adaptive, scalable, and resilient even when conditions change or individual robots become unavailable.¹⁰

IMPACT AND RESULTS

SIRBAI is expected to accelerate the development of reliable autonomous robotic swarms for real-world and industrial missions. It will expand operational coverage by enabling multiple robots to work simultaneously across large areas while improving resilience when individual units or communication links fail. Its distributed intelligence will support faster decision-making without constant dependence on a central control system.¹¹

The platform could also reduce human exposure to hazardous environments during disaster response, infrastructure inspection and maintenance. As a repeatable testbed, SIRBAI will help researchers validate swarm behaviours under realistic conditions and translate scientific advances into deployable solutions. It will support future applications in environmental monitoring, logistics, public safety, and critical-infrastructure management. Collaboration around the platform should attract international research partners and contribute to developing specialised talent in the UAE. It will also strengthen the country's sovereign capabilities in robotics, physical AI, and autonomous systems. Ultimately, SIRBAI can help turn ARRC's research into scalable technologies that generate economic, strategic, and societal value.¹²



WHAT'S NEXT

The next step for SIRBAI and ARRC is to move from controlled experimentation toward larger pilot deployments in real industrial environments. SIRBAI could support 4IR applications such as smart-factory inspection, autonomous logistics, infrastructure monitoring, environmental sensing, and emergency response. Its swarm architecture will need to integrate securely with industrial IoT platforms, digital twins, edge computing, and AI-driven command systems. Further testing should demonstrate safe and reliable operation under harsh conditions, limited connectivity, and changing mission requirements.¹³

ARRC will work with regulators, industrial partners, and emergency services to establish standards for certification, data governance, cybersecurity, and human oversight. The platform will then evolve into modular solutions that can be adapted to different industries and combinations of aerial, ground, and marine robots. In the longer term, SIRBAI could become an important foundation for sovereign physical-AI capabilities and scalable autonomous operations across the UAE's 4IR economy.¹⁴

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