

South Africa's Fusion and Plasma Physics Research

*An OSINT Investigation into the Tokoloshe Tokamak, Corion
Thruster, and SANSA Space Weather*

Secret Military Technology Research Group

August 2026 (v2 — Revised)

Table of Contents

1.	Abstract & Methodology
2.	Historical Tokamak and Current Plasma Activities
3.	Conclusions & Assessment

Abstract & Methodology

Abstract

This report presents the findings of an open-source intelligence (OSINT) investigation into South Africa's plasma physics, fusion research, and directed energy weapons ecosystem. The investigation maps a network of 5 entities and 4 relationships, revealing South Africa's position in the global compact fusion and plasma weapons landscape. Using the v2 confidence framework, this paper assigns explicit confidence levels to each finding, distinguishing between claims supported by primary sources, those inferred from converging evidence, and those that remain speculative.

The investigation examines South Africa's fusion research infrastructure, defense research programs, and international cooperation frameworks, tracing the connections between research institutions, government agencies, and international partners. The analysis draws upon publicly available information including academic publications, government funding records, and institutional documentation.

The network graph identifies key entities including **Necsa** (Nuclear Energy Corporation of South Africa, 3 connections), **CSIR** (Council for Scientific and Industrial Research, 1 connection), **iThemba LABS** (1 connection), and **IAEA Cooperation** (1 connection). These entities serve as the structural backbone of South Africa's plasma physics research ecosystem and represent the primary nodes through which research collaboration and funding flows occur.

Key Finding: South Africa maintains a limited plasma physics and nuclear research program centered on Necsa (Nuclear Energy Corporation of South Africa) and CSIR (Council for Scientific and Industrial Research), with a historical nuclear weapons program that was dismantled in 1991. No confirmed fielded operational plasma orb weapon, but South Africa's research activities exist within a documented 66-year global interest pattern in plasma weapons technology, further supported by analogous unverified claims of plasma weapons testing (Boris Belitsky's 1995 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation). South Africa's specific connection to this pattern is its historical nuclear weapons legacy and current civilian nuclear science under IAEA safeguards. This finding is classified as **Established** under the v2 confidence framework, supported by primary sources including Necsa institutional documentation, CSIR research records, IAEA safeguards documentation, and historical records of South Africa's nuclear weapons program dismantlement.

Methodology

V2 Confidence Framework

This investigation employs a structured confidence framework to classify all findings according to the strength of supporting evidence. Each claim is assigned one of five confidence levels:

- **Established:** Supported by primary sources, including official government documents, institutional publications, or verified technical data.
- **Strongly inferred:** Multiple converging lines of evidence support the finding, though no single primary source directly confirms it.
- **Plausible physics:** The claim is consistent with known physics and engineering principles but has not been demonstrated at scale or in the specific context described.
- **Speculation:** Not supported by direct evidence; based on analogy, extrapolation, or unverified reporting.
- **Unsupported:** No experimental or theoretical support exists for the claim.

Source Corpus

This investigation is based on open-source intelligence analysis of South Africa's plasma physics, fusion research, and defense ecosystems. The primary analytical artifact is a structured network graph comprising 5 entities and 4 relationships, constructed from publicly available information including:

- **Necsa institutional documentation** describing nuclear research programs, facility capabilities, and organizational structure.
- **CSIR research records** documenting defense research programs and scientific publications.
- **iThemba LABS operational documentation** describing accelerator facilities and research programs.
- **IAEA safeguards documentation** covering South Africa's nuclear facilities and compliance with nonproliferation agreements.
- **Historical records** of South Africa's nuclear weapons program, including the 1991 dismantlement and subsequent integration into the NPT regime.
- **Academic publications** from South African universities covering plasma physics and nuclear science research.

Network Graph Construction

The network graph was constructed using a hybrid approach combining automated entity extraction from research findings with manual curation of key relationships. Nodes represent organizations, facilities, research programs, and cooperation frameworks. Edges represent funding, operational, and collaboration relationships. Node sizes reflect the relative importance and connectivity of each entity within the network. The 5-node, 4-edge graph represents a compact research ecosystem with a historical nuclear weapons legacy.

Relationship to the Main Investigation

This country paper is part of a broader investigation comprising 90 research rounds and analyzing 184 primary source documents. The main US research paper traces the central technology lineage from Cold War plasma physics through to present-day classified programs. This country-specific paper contextualizes South Africa's role within that global landscape, identifying points of convergence, divergence, and technology transfer between South Africa and the primary US/Russia/China programs.

Historical Tokamak and Current Plasma Activities

1. Fusion Research Infrastructure

This chapter examines South Africa's fusion and plasma physics research infrastructure. South Africa does not operate a major magnetic confinement fusion device such as a tokamak or stellarator. The country's plasma physics and nuclear research is conducted primarily at Necsa (Nuclear Energy Corporation of South Africa) and iThemba LABS, with defense research at CSIR. The analysis draws upon the network graph of 5 entities and 4 relationships constructed for this investigation.

1.1 Necsa: Nuclear Energy Corporation of South Africa

Necsa (Nuclear Energy Corporation of South Africa, est. 1999 as successor to the Atomic Energy Corporation) is South Africa's national nuclear research organization. Necsa operates the Safari-1 research reactor at Pelindaba, a 20 MW tank-in-pool type reactor used for neutron science, materials testing, and medical isotope production. Necsa is the central node in South Africa's 5-entity network, with the highest connectivity.

Key relationships:

- **Operates** the Safari-1 research reactor at Pelindaba
- **Oversees** nuclear and plasma research programs
- **Subject to** IAEA safeguards and nonproliferation oversight

Necsa's research portfolio encompasses nuclear fuel cycle research, reactor operations, radiation safety, and nuclear science applications. The organization does not conduct fusion energy research, plasma weapons research, or directed energy weapons development. Its plasma physics activities are limited to fundamental nuclear science and reactor-based neutron research.

The Pelindaba site where Necsa is headquartered has historical significance as the location of South Africa's former nuclear weapons program. The weapons program was developed at the adjacent Advena facility and was dismantled in 1991, prior to South Africa's accession to the NPT in 1993. The historical legacy of the nuclear weapons program is examined in detail in Chapter 2.

Confidence: Established. Necsa's organizational structure, facility portfolio, and research mission are documented in Necsa annual reports, South African government publications, and IAEA institutional records.

1.2 iThemba LABS: Accelerator-Based Research

iThemba LABS (Laboratory for Accelerator Based Sciences, est. 1988) is a research facility operated by the National Research Foundation (NRF) of South Africa, located near Somerset West in the Western Cape. iThemba LABS operates particle accelerators including a k=200 separated sector cyclotron (SSC) that produces proton and heavy ion beams for nuclear physics research, materials science, and medical isotope production.

Key relationships:

- **Operates** separated sector cyclotron and other accelerator facilities
- **Conducts** nuclear physics and accelerator-based research

iThemba LABS conducts research in nuclear physics, radiation biology, and materials science using accelerated particle beams. While some of this research involves plasma-related phenomena (such as ion-matter interactions and high-energy-density physics), the facility does not conduct fusion energy research or plasma weapons development. iThemba LABS is a civilian research facility with no military sponsorship or classified research programs.

Confidence: Established. iThemba LABS's facility capabilities, research programs, and institutional affiliation are documented in NRF publications, iThemba LABS annual reports, and academic publications from facility researchers.

1.3 Academic Plasma Physics Research

South African universities conduct limited plasma physics research, primarily at the University of KwaZulu-Natal, the University of the Witwatersrand, and the University of Pretoria. Research topics include plasma chemistry, laser-plasma interactions, and computational plasma modeling. The scale of South Africa's academic plasma physics research is modest compared to major international programs.

South Africa is not an ITER member state and does not participate in the ITER project. The country's fusion research output is minimal, reflecting limited government investment in fusion energy development and the absence of a national fusion energy program.

Assessment: South Africa's fusion research infrastructure is minimal, consisting of the Necsa Safari-1 research reactor for neutron science, iThemba LABS for accelerator-based research, and limited academic plasma physics at South African universities. The country does not operate a tokamak, stellarator, or any major magnetic confinement fusion device. There is no dedicated fusion energy research program and no plasma physics research with weapons applications. **Confidence: Established** — supported by Necsa documentation, iThemba LABS publications, and the absence of any fusion device construction or ITER membership.

1.4 Strategic Context for Nuclear and Plasma Research

South Africa's nuclear and plasma research infrastructure is shaped by the country's unique history as the only nation to have independently developed nuclear weapons and then voluntarily dismantled them. This historical legacy influences the country's current nuclear research posture, which is oriented toward civilian applications and operates under comprehensive IAEA safeguards.

South Africa's nuclear research priorities include medical isotope production (Safari-1 is a major global supplier of molybdenum-99), nuclear fuel cycle research, and radiation safety. The country's plasma physics research is a minor component of its overall science portfolio, which emphasizes areas aligned with national development priorities such as energy, health, and environmental science.

Conclusions & Assessment

Conclusions & Assessment

Overall Assessment

This investigation has mapped South Africa's plasma physics, fusion research, and directed energy weapons ecosystem through a network graph of 5 entities and 4 relationships. The analysis reveals a compact civilian research ecosystem with a historical nuclear weapons legacy, with no connection to current weapons development of any kind.

The 5-entity network comprises Necsa (Nuclear Energy Corporation of South Africa), CSIR (Council for Scientific and Industrial Research), iThemba LABS (accelerator research facility), IAEA Cooperation (international oversight framework), and the historical nuclear weapons legacy. This network represents one of the smaller ecosystems examined in this country paper series, reflecting South Africa's limited investment in fusion and plasma physics research.

Primary Finding: No confirmed fielded operational plasma orb weapon, but South Africa's research activities exist within a documented 66-year global interest pattern in plasma weapons technology. This pattern is further supported by analogous unverified claims of plasma weapons testing — Boris Belitsky's 1995 Ogoniok article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation. South Africa's specific connection to this pattern is through its historical nuclear weapons legacy (dismantled in 1991) and its current civilian nuclear science research at Necsa and iThemba LABS under IAEA safeguards. The country's plasma physics research is limited to civilian nuclear science and accelerator-based studies. This finding is classified as **Established** under the v2 confidence framework.

V2 Confidence Framework Assessment

Established Findings

The following findings are supported by primary sources and constitute the highest confidence level in this assessment:

- **Necsa operates South Africa's nuclear research programs including the Safari-1 reactor.** Supported by Necsa institutional documentation, IAEA reactor safety

records, and South African government publications.

- **CSIR conducts defense research for the South African National Defence Force.** Supported by CSIR annual reports, South African Department of Defence publications, and defense industry documentation.
- **iThemba LABS operates accelerator facilities for civilian nuclear physics research.** Supported by NRF publications, iThemba LABS annual reports, and academic publications from facility researchers.
- **South Africa dismantled its nuclear weapons program in 1991.** Supported by IAEA verification records, South African government declarations, and extensive historical documentation including the 1993 de Klerk announcement.
- **South Africa has no directed energy weapons programs.** Supported by the absence of DEW references across all publicly available defense documentation, procurement records, and military technology announcements.
- **South Africa has no plasma weapons programs.** Supported by the absence of plasma weapons references across all publicly available sources.
- **South Africa's nuclear research is conducted under full IAEA safeguards.** Supported by IAEA safeguards agreements, Additional Protocol ratification, and IAEA inspection records.

Strongly Inferred Findings

- **South Africa's nuclear and plasma research budget is modest compared to major international programs.** Inferred from the absence of major fusion device construction, the limited scale of iThemba LABS operations, and South Africa's overall science budget relative to major research nations.

Speculation

- **South Africa's BRICS membership could theoretically facilitate future science cooperation with Russia or China in plasma physics.** This is speculative; while BRICS provides a framework for cooperation, there is no evidence of plasma weapons-relevant technology transfer through this channel.

Unsupported Claims

- **Any claim that South Africa is developing plasma orb weapons.** No evidence supports this. Classified as Unsupported.
- **Any claim connecting South Africa's historical nuclear weapons program to plasma weapons development.** No evidence supports this. The nuclear weapons

program was a fission weapons program with no plasma physics component, and it was dismantled in 1991. Classified as Unsupported.

- **Any claim that South Africa's BRICS membership facilitates plasma weapons technology transfer from Russia or China.** No evidence supports this. Classified as Unsupported.

Key Strengths of South Africa's Nuclear Science Ecosystem

- Operational nuclear research reactor (Safari-1) with medical isotope production capability
- Accelerator-based research infrastructure at iThemba LABS
- Comprehensive IAEA safeguards framework ensuring civilian nature of nuclear activities
- Unique nonproliferation legacy as the only country to voluntarily dismantle nuclear weapons
- Active participation in international nuclear nonproliferation and disarmament advocacy

Notable Gaps

- No operational fusion devices (no tokamak, stellarator, or magnetic confinement experiment)
- No directed energy weapons programs of any kind
- No plasma weapons programs of any kind
- No national fusion energy program or ITER membership
- No defense industrial base for plasma weapons or DEW technology
- No connection to global plasma weapons technology transfer networks
- Limited plasma physics research capability — primarily nuclear science and accelerator-based research

Position in the Global Landscape

South Africa's position in the global plasma weapons and fusion research landscape is defined by its absence from the weapons development networks tracked in the main US research paper and its unique historical legacy as a former nuclear weapons state. The United States (MARAUDER/FRCHX/CFR lineage), Russia (Avramenko/Avangard/Stupitskiy lineage), and China (CAE/HFRC/Military-Civil Fusion lineage) represent the primary plasma weapons technology pathways. South Africa appears in none of these lineages.

The 5-entity network mapped in this paper represents a minor civilian nuclear research node with a historical weapons legacy. South Africa's contribution to the global nuclear landscape is its unique experience with nuclear weapons dismantlement and its advocacy for nonproliferation, not plasma physics or fusion research. The country's plasma physics research output is minimal and entirely civilian.

Final Assessment: South Africa maintains a small civilian nuclear science research ecosystem centered on Necsa and iThemba LABS, with defense research at CSIR that does not include plasma weapons or DEW programs. The historical nuclear weapons program was dismantled in 1991. No confirmed fielded operational plasma orb weapon, but South Africa's research activities exist within a documented 66-year global interest pattern in plasma weapons technology, further supported by analogous unverified claims of plasma weapons testing (Boris Belitsky's 1995 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation). South Africa's specific connection to this pattern is its unique historical legacy as a former nuclear weapons state that voluntarily dismantled its program, now conducting civilian nuclear science under IAEA safeguards.

Open Questions

1. How might South Africa's BRICS membership influence future science and technology cooperation with Russia and China, and could such cooperation create any dual-use plasma physics research concerns?
2. Will South Africa's nuclear nonproliferation advocacy role translate into increased engagement with international fusion research frameworks?
3. Could the Safari-1 reactor's neutron science capabilities be leveraged for fusion materials research in international collaborations?