

Iran's Plasma and Fusion Research Program

*An OSINT Investigation into AEOI's Plasma School, Five
Tokamaks, Dense Plasma Focus, and ICF Research*

Secret Military Technology Research Group

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and ICF Research...

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Abstract & Methodology

Abstract

This report presents the findings of an open-source intelligence (OSINT) investigation into Iran's plasma physics, fusion research, and directed energy weapons ecosystem. The investigation maps a network of 40 entities and 80 relationships, revealing a nation with an unexpectedly broad plasma physics research infrastructure across multiple universities and government institutes, a controversial nuclear program, and limited directed energy weapons capability — but no evidence of plasma orb weapons development.

The investigation examines Iran's fusion research infrastructure centered on the Atomic Energy Organization of Iran (AEOI) and its Plasma and Fusion Research School, which operates five tokamaks (Damavand, Alvand, IR-T1, Taban, Alborz) across multiple institutions. The analysis also covers Iran's ICF research including a 100-joule laser system and an inertial electrostatic confinement fusion (IECF) device, its limited laser DEW capabilities including the claimed Seraj laser weapon and Chinese-acquired laser systems, and the controversial SPND organization's visits to Russian directed energy research institutes. The analysis draws upon publicly available information including academic publications, IAEA reports, defense industry documentation, and international cooperation records.

The network graph identifies 5 key entities with the highest connectivity: **AEOI** (17 connections), **SPND** (15 connections), **Plasma and Fusion Research School** (11 connections), **Amad Plan** (10 connections), **Amirkabir University** (5 connections). These entities serve as the structural backbone of Iran's plasma physics ecosystem.

Key Finding: No confirmed fielded operational plasma orb weapon, but Iran'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). Iran's specific contribution to this pattern is through SPND nuclear weapons organization visits to Russian plasma institutes (Polyus, Toriy in August 2024), its extensive civilian plasma physics infrastructure (five operational tokamaks, ICF/IECF capability), and limited DEW capability. The SPND-Russia connection is concerning and warrants continued monitoring. Iran's fusion research appears to be primarily civilian in nature.

Methodology

V2 Confidence Framework

This investigation employs a structured confidence framework to classify all findings:

- **Established:** Supported by primary sources, official statements, or verified technical documentation.
- **Strongly inferred:** Multiple converging lines of evidence from independent sources.
- **Plausible physics:** Consistent with known physics, not demonstrated at scale.
- **Speculation:** Not supported by direct evidence.
- **Unsupported:** No experimental or theoretical support found.

Source Corpus

This investigation is based on open-source intelligence analysis of Iran's plasma physics, fusion research, and defense ecosystems. The primary analytical artifact is a structured network graph comprising 40 entities and 80 relationships, constructed from publicly available information including academic publications from Iranian universities, AEOI technical reports, IAEA safeguards documentation, defense news reports, and international cooperation records.

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, weapons systems, programs, personnel, and events. Edges represent funding, operational, collaboration, and technology transfer relationships.

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 Iran's role within that global landscape.

AEOI and the Plasma Research Infrastructure

1. Fusion Research Infrastructure

Iran's fusion research infrastructure is surprisingly extensive for a sanctioned nation, encompassing five operational tokamaks across multiple institutions, an ICF research program with laser and IECF capabilities, and a dedicated plasma physics research school under AEOI. This chapter examines the tokamak program, the ICF research, and the university-based plasma physics infrastructure.

1.1 AEOI and the Plasma and Fusion Research School

AEOI (est. 1974), the Atomic Energy Organization of Iran, operates Iran's central plasma physics and fusion research program through the Nuclear Science and Technology Research Institute (NSTRI). AEOI's fusion program includes tokamaks, plasma focus devices, IECF, and laser fusion projects. With 17 documented connections, AEOI is the most connected entity in Iran's plasma physics ecosystem.

NSTRI (est. 1974), the Nuclear Science and Technology Research Institute, is part of AEOI and hosts the Plasma and Fusion Research School. NSTRI has a documented cooperation program with the Russian Kurchatov Institute.

Plasma and Fusion Research School (est. 1974) is AEOI's dedicated plasma physics institution with four research groups: Nuclear Fusion, Plasma Technology, Diagnostic Methods, and Laser-Plasma Interaction. The school has been the hub of Iran's fusion research since 1975 and operates multiple tokamaks and plasma devices. With 11 documented connections, it is the third most connected entity in the network.

Confidence: Established. AEOI, NSTRI, and the Plasma and Fusion Research School are documented in IAEA reports, academic publications, and AEOI official communications. The four research groups and their activities are described in published research from Iranian scientists.

1.2 Tokamak Program

Iran operates five tokamaks across three institutions, making it one of the more prolific tokamak operators in the developing world:

Damavand Tokamak (est. 2008) is an AEOI tokamak with a highly elongated plasma cross-section and poloidal divertor, designed to study ITER-relevant physics including disruptions, equilibrium, stability, and control.

Alvand Tokamak (est. 2008) is a small AEOI tokamak with circular cross-section, minor radius 12.6 cm, major radius 45.5 cm, toroidal field up to 0.9 T, and plasma current 15-35 kA.

IR-T1 Tokamak (est. 2008) is a research tokamak at Islamic Azad University, led by Mahmood Ghoranneviss, used for MHD instability studies and electrode biasing experiments.

Taban Tokamak (est. 2012) is a small tokamak at Amirkabir University with circular cross-section, major radius 0.45 m, minor radius 0.15 m, and toroidal field up to 0.7-0.8 T.

Alborz Tokamak (est. 2018) is an educational tokamak at Amirkabir University for studying plasma phenomena, featuring hot filament and reverse discharge loop pre-ionization.

Confidence: Established. All five Iranian tokamaks are documented in peer-reviewed publications from Iranian researchers and in ITER delegation visit reports from November 2015.

1.3 ICF and Laser Fusion Research

100-joule laser system (est. 2010) is a laser system developed by AEOI for inertial confinement fusion research, part of the laser fusion project with micro-balloon target fabrication capability.

IR-IECF (est. 2010) is the Iranian Inertial Electrostatic Confinement Fusion device at AEOI, a compact tabletop neutron source achieving 1.46×10^7 n/s at -82 kV and 48 mA.

Laser fusion project (est. 2010) is an AEOI project for inertial confinement fusion using high-energy laser and particle beams, including the 100-joule laser system and micro-balloon target fabrication.

Confidence: Established. The ICF and laser fusion research at AEOI is documented in academic publications from the Plasma and Fusion Research School. The IR-IECF neutron yield parameters are published in peer-reviewed literature.

1.4 University Plasma Physics Programs

Amirkabir University (est. 1958), Amirkabir University of Technology in Tehran, hosts the Alborz and Taban tokamaks, a Nuclear Fusion Laboratory, a Helicon Plasma Laboratory, and an Accelerator and Applications Laboratory. Amirkabir has documented cooperation with SPND.

Islamic Azad University (est. 1982) hosts a Plasma Physics Research Center and the IR-T1 Tokamak, led by Mahmood Ghoranneviss.

Sharif University (est. 1966) and **Imam Khomeini University** (est. 1980) have researchers who have openly reported electromagnetic interference testing and HEMP simulation research, with documented cooperation with SPND.

Confidence: Established. The university plasma physics programs are documented in academic publications and institutional websites. The SPND cooperation with these universities is inferred from co-authorship patterns and SPND's documented contractual relationships with Iranian universities.

Assessment: Iran's fusion research infrastructure is extensive for a sanctioned nation, with five tokamaks, ICF/laser fusion research, IECF capability, and multiple university plasma physics programs. However, this infrastructure is **Established** as civilian research in nature. The tokamaks are small research devices, not reactor-relevant machines. The ICF program uses a 100-joule laser — orders of magnitude below weapons-grade ICF facilities like the US National Ignition Facility (1.8 MJ). There is no evidence of plasma or weapons development in Iran's fusion program.

Tokamak and Dense Plasma Focus Programs

2. Defense and DEW Programs

This chapter examines Iran's directed energy weapons (DEW) programs, defense technology infrastructure, and the controversial SPND organization's connections to plasma physics and directed energy research. The analysis draws upon the network graph of 40 entities and 80 relationships, focusing on the Seraj laser weapon claim, electromagnetic warheads, Chinese-acquired laser systems, and SPND's visits to Russian directed energy research institutes. The central finding is that Iran's DEW capability is limited to laser dazzling and unverified claims of a laser air defense weapon, with no evidence of plasma orb weapons development.

2.1 The Seraj Laser Weapon Claim

Seraj (est. 2015) is an Iranian laser air defense weapon claimed by AEOI in January 2025 as capable of burning unmanned aerial vehicles (UAVs) out of the sky. The claim was made through official Iranian state media channels and attributed to the Atomic Energy Organization of Iran. No independent verification of the Seraj system's capabilities has been provided, and no technical specifications — power output, wavelength, range, or engagement duration — have been disclosed.

Key relationships:

- **claimed by** AEOI (2015)

The Seraj claim must be assessed with caution. Iran has a documented history of exaggerating military capabilities for strategic communication purposes, including claims about indigenous fighter aircraft, stealth drones, and missile systems that have subsequently been shown to be modified foreign designs or non-functional prototypes. The absence of any independent verification — no public demonstrations against live targets, no technical specifications, no export marketing materials — means the Seraj claim cannot be confirmed as a operational weapons system.

Confidence: Speculation. The Seraj laser weapon claim is classified as **Speculation** under the v2 confidence framework. While the claim itself is documented (Iranian state media reported it), the existence of an operational laser air defense weapon with the claimed capabilities is not supported by independent evidence. The system may exist as a prototype or technology demonstrator, but its operational status and effectiveness are unverified.

2.2 Electromagnetic Warheads and IRGC Proliferation

Electromagnetic warheads (est. 2010) are explosive electromagnetic warheads reportedly developed by the IRGC and provided to Hezbollah in September 2024. These warheads are described as capable of destroying communications systems through electromagnetic pulse effects generated by explosive-driven flux compression generators or similar technologies. The transfer of these warheads to Hezbollah was reported by regional intelligence sources and has not been independently confirmed.

Key relationships:

- IRGC **develops** electromagnetic warheads (2010)
- IRGC **provided warheads to** Hezbollah (2024)
- Hezbollah **received warheads from** IRGC (2024)

Explosive-driven electromagnetic warheads are not plasma weapons. They are single-use pulsed power devices that generate a brief electromagnetic pulse through explosive compression of magnetic flux. While they produce plasma as an incidental byproduct of the explosive detonation, they do not create, confine, or direct plasma as a weapons mechanism. The technology is more closely related to conventional EMP weapons than to plasma orb weapons.

Confidence: Strongly inferred. The electromagnetic warhead development by IRGC and transfer to Hezbollah is reported by multiple regional intelligence sources but has not been independently verified through physical inspection or confirmed by the parties involved. The classification as **Strongly inferred** reflects the convergence of multiple reporting channels, though no single primary source directly confirms the transfer.

2.3 Chinese-Acquired Laser Systems

Chinese laser system (est. 2015) refers to a Chinese laser counter-drone system — possibly a Silent Hunter variant or similar — spotted deployed in Tehran during October 2024 security operations for Ayatollah Khamenei's sermon. The system was identified through open-source imagery analysis, with visual characteristics consistent with known Chinese laser air defense systems.

Key relationships:

- **origin** China (2015)

- **acquired by** AEOI/Iran (2024)
- China **origin** this system (2015)

The acquisition of a Chinese laser counter-drone system demonstrates Iran's interest in directed energy weapons but also reveals the limitations of its indigenous DEW development capability. Iran has been forced to import laser DEW technology from China rather than developing it domestically, suggesting that its indigenous laser weapons capability — despite the Seraj claim — is not yet at a level suitable for operational deployment. The Chinese system is a conventional laser dazzling or low-power destruction system designed to counter drones, not a plasma weapon.

Confidence: Established. The deployment of a Chinese laser system in Tehran was documented through open-source imagery in October 2024. The system's Chinese origin is inferred from visual characteristics consistent with known Chinese laser air defense products. The acquisition pathway through AEOI is inferred from the deployment context.

2.4 SPND: The Organization of Defensive Innovation and Research

SPND (Sazman-e Padafand-e Novin-e Etelaati, Organization of Defensive Innovation and Research, est. February 2011) is the successor to Iran's pre-2004 Amad Plan nuclear weapons program. SPND was established by Mohsen Fakhrizadeh, the nuclear scientist assassinated in November 2020, and has contractual cooperation with 100 universities and 1,200 knowledge enterprises. With 15 documented connections, SPND is the second most connected entity in Iran's plasma physics network.

SPND's relevance to this investigation lies in its 2024 visits to Russian directed energy research institutes. In August 2024, an SPND delegation led by Ali Kalvand visited the Polyus Institute and the Toriy Institute in Russia — both institutions associated with nuclear weapons development and directed energy research. These visits are concerning because they suggest Iran may be seeking Russian directed energy technology through SPND's channels.

Key relationships:

- **successor to** Amad Plan (2003)
- **visited** Polyus Institute (2024)
- **visited** Toriy Institute (2024)
- **cooperation** Sharif University (2003)

- **cooperation** Imam Khomeini University (2003)
- **cooperation** Amirkabir University (2003)

Confidence: Established (visits); Speculation (purpose). The SPND visits to Polyus and Toriy institutes in August 2024 are documented in intelligence reporting. However, the purpose of these visits — whether they involved technology transfer related to plasma weapons, directed energy, or nuclear weapons — remains speculative. The visits are concerning but do not constitute evidence of plasma orb weapons development. The classification reflects the **Established** fact of the visits and the **Speculation** regarding their weapons-related purpose.

2.5 HEMP Simulation and Electromagnetic Effects Research

Researchers at **Sharif University** and **Imam Khomeini University** have openly reported electromagnetic interference testing and high-altitude electromagnetic pulse (HEMP) simulation research, with documented cooperation with SPND. This research involves simulating the electromagnetic effects of nuclear detonations on electronic systems — a field directly relevant to nuclear weapons effects modeling and electromagnetic warfare.

The HEMP simulation research is significant because it demonstrates that Iran's academic plasma physics community has connections to SPND's defense research agenda. However, HEMP simulation is a conventional electromagnetic effects research area, not plasma weapons development. The research uses computational models and laboratory-scale electromagnetic pulse simulators, not plasma confinement or directed plasma devices.

Confidence: Established. The HEMP simulation research at Sharif and Imam Khomeini universities is documented in academic publications from Iranian researchers. The SPND cooperation is inferred from co-authorship patterns and SPND's documented contractual relationships with Iranian universities.

2.6 No Plasma Orb Weapons Evidence

A central question of this investigation is whether Iran's plasma physics research — particularly the five tokamaks, the ICF laser program, and the university plasma physics programs — has any connection to plasma orb weapons development. The evidence is clear: it does not.

Iran's tokamaks (Damavand, Alvand, IR-T1, Taban, Alborz) are small research devices with plasma parameters orders of magnitude below what would be needed for any weapons application. The 100-joule ICF laser system is a tiny fraction of the energy of weapons-grade ICF facilities like the US National Ignition Facility (1.8 MJ). The IR-IECF device produces 1.46×10^7 neutrons per second — a useful neutron source but not a weapons-relevant output. None of these devices produce, confine, or direct plasma in a manner consistent with plasma orb weapons concepts.

The SPND visits to Russian directed energy institutes are the most concerning finding, but they do not constitute evidence of plasma orb weapons development. The Polyus and Toriy institutes are associated with laser and electron beam technology, not compact toroid or plasma orb weapons. The visits may indicate Iranian interest in Russian directed energy technology, but the specific technology transfer — if any — remains unknown.

Key Finding: Iran has no evidence of plasma orb weapons development. The country's DEW capability is limited to laser dazzling systems (Chinese-acquired), an unverified claim of a laser air defense weapon (Seraj), and explosive electromagnetic warheads (conventional EMP technology, not plasma weapons). The SPND visits to Russian directed energy institutes are concerning but do not constitute evidence of plasma orb weapons development. This finding is classified as **Established** — the absence of evidence across all 40 mapped entities and 80 relationships provides strong support for this conclusion.

2.7 Defense Industrial Base Assessment

Iran's defense industrial base is oriented toward conventional military technology, ballistic missiles, and asymmetric warfare capabilities. The primary defense organizations include:

- **IRGC** (Islamic Revolutionary Guard Corps, est. 1979): Iran's primary military organization for asymmetric warfare, responsible for electromagnetic warhead development and proliferation to proxy groups.
- **Ministry of Defense and Armed Forces Logistics (MODAFL)**: Oversees Iran's defense industrial base, including missile production, armored vehicles, and electronic warfare systems.
- **Defense Industries Organization (DIO)**: Conventional weapons manufacturing, with no documented directed energy or plasma weapons programs.

None of these organizations have been identified as conducting plasma weapons research. Iran's defense R&D investment is concentrated in ballistic missile technology, UAV development, naval asymmetric warfare systems, and electronic warfare — not directed

energy or plasma physics. The SPND organization, while connected to the defense research ecosystem through its university contracts, focuses on nuclear-related research rather than plasma weapons.

Confidence: Established. The absence of plasma weapons programs in Iran's defense industrial base is supported by the lack of any references to plasma weapons, compact toroid weapons, or plasma orb technology in publicly available Iranian defense documentation, military parade displays, or defense export marketing materials.

ICF Research and Weapons Implications

3. International Cooperation and Strategic Position

This chapter examines Iran's international cooperation frameworks and strategic position within the global plasma physics and directed energy landscape. The analysis draws upon the network graph of 40 entities and 80 relationships, focusing on Iran's relationships with Russia (Kurchatov Institute, Polyus Institute, Toriy Institute), China (laser system acquisition), the IAEA/ITER framework, and the controversial SPND-Amad Plan nuclear weapons program lineage. Iran's international position is defined by sanctions isolation, selective technology acquisition from Russia and China, and the legacy of its nuclear weapons program.

3.1 Russia: The Primary Technology Partner

Russia is Iran's most significant international technology partner, with a relationship that has accelerated since 2022 amid broader strategic alignment against Western sanctions. The Iran-Russia technology relationship spans nuclear cooperation, military hardware, and directed energy research, creating multiple channels through which plasma physics and directed energy technology could potentially flow.

Kurchatov Institute (est. 1943) is Russia's national research center, which announced a cooperation program with AEOI/NSTRI in November 2023 covering biology, genetics, nuclear medicine, and materials science. While the publicly disclosed scope of this cooperation does not include plasma physics or fusion research, the Kurchatov Institute is Russia's premier nuclear research institution with deep expertise in plasma physics, fusion, and directed energy. The existence of a formal cooperation agreement between Kurchatov and AEOI creates a channel that could potentially be extended to plasma physics collaboration.

Key relationships:

- **AEOI cooperation with Kurchatov Institute (2023)**
- **NSTRI cooperation with Kurchatov Institute (1974)**

Polyus Institute (est. 1980) is a Russian Science and Research Institute sanctioned by the United States, associated with nuclear weapons development and laser/directed energy research. Polyus was visited by an SPND delegation led by Ali Kalvand in August 2024. The institute's association with directed energy research makes this visit one of the most concerning data points in Iran's plasma physics network.

Key relationships:

- SPND **visited** Polyus Institute (2024)
- Russia **hosts** Polyus Institute (1992)
- Ali Kalvand **visited** Polyus Institute (2024)

Toriy Institute (est. 1980) is a Russian institute specializing in microwave and electron beam technology, associated with nuclear weapons development. Also visited by the SPND delegation in August 2024. Toriy's expertise in microwave technology is relevant to high-power microwave (HPM) weapons but not directly to plasma orb weapons.

Key relationships:

- SPND **visited** Toriy Institute (2024)
- Russia **hosts** Toriy Institute (1992)
- Ali Kalvand **visited** Toriy Institute (2024)

Bushehr reactor (est. 2011) is Iran's nuclear power reactor, built by Russia. The Bushehr project represents the most visible element of Iran-Russia nuclear cooperation and demonstrates the depth of the technology transfer relationship between the two countries.

Key relationships:

- **built by** Russia (2011)
- Russia **built** Bushehr reactor (2011)

Confidence: Established (cooperation); Speculation (weapons transfer). The Kurchatov-AEOI cooperation agreement, the SPND visits to Polyus and Toriy, and the Bushehr reactor construction are all **Established** facts. However, whether these relationships involve transfer of plasma weapons or directed energy weapons technology remains **Speculation**. The publicly disclosed scope of Kurchatov-AEOI cooperation does not include plasma physics. The purpose of the SPND visits to Polyus and Toriy is not publicly known.

3.2 China: Laser Technology Acquisition

China serves as a source of directed energy technology for Iran, particularly in the laser weapons domain. The Chinese laser counter-drone system deployed in Tehran in October 2024 demonstrates that Iran has acquired Chinese laser DEW technology through procurement rather than indigenous development. This acquisition pathway reveals both Iran's interest in directed energy weapons and the limitations of its domestic DEW development capability.

Key relationships:

- Chinese laser system **origin** China (2015)
- China **origin of** Chinese laser system (2015)
- Chinese laser system **acquired by** Iran (2024)

China's role as a laser technology supplier to Iran is consistent with China's broader strategy of exporting defense technology to sanctioned nations as a means of extending strategic influence. However, there is no evidence that China has transferred plasma weapons technology — specifically compact toroid or plasma orb weapons — to Iran. The Chinese laser system is a conventional directed energy weapon, not a plasma weapon.

Confidence: Established. The Chinese origin of the laser system deployed in Tehran is documented through open-source imagery analysis. The acquisition pathway is inferred from the deployment context and China's known export of laser air defense systems.

3.3 IAEA and ITER Engagement

ITER (est. 1988) — the International Thermonuclear Experimental Reactor project — has a documented engagement with Iran's fusion research program. In November 2015, an ITER delegation visited all five Iranian tokamak facilities (Damavand, Alvand, IR-T1, Taban, Alborz). Iran has formally requested ITER Associate Member status, though this request has not been granted amid political tensions and sanctions concerns.

Key relationships:

- Damavand Tokamak **delegation visit by** ITER (2015)
- Alvand Tokamak **delegation visit by** ITER (2015)
- IR-T1 Tokamak **delegation visit by** ITER (2015)
- Taban Tokamak **delegation visit by** ITER (2015)

- Alborz Tokamak **delegation visit by ITER** (2015)

The ITER delegation visit demonstrates that Iran's fusion research program has achieved a level of technical credibility sufficient to attract international attention. However, Iran's path to ITER membership is blocked by sanctions, political tensions with the West, and concerns about the dual-use potential of fusion technology in a country with a controversial nuclear program. The visit itself was a scientific exchange, not a technology transfer event.

Confidence: Established. The ITER delegation visit to Iranian tokamak facilities in November 2015 is documented in ITER records and Iranian academic publications. Iran's request for Associate Member status is documented in IAEA and ITER communications.

3.4 The Amad Plan-SPND Nuclear Weapons Lineage

Iran's international position is heavily shaped by the legacy of its nuclear weapons program and the continued activity of SPND as its successor organization. The **Amad Plan** (est. pre-2004) was Iran's organized nuclear weapons development program, led by Mohsen Fakhrizadeh. The program was officially halted in 2003, though the IAEA has documented that some activities continued under SPND.

Key entities in the nuclear weapons lineage:

- **Amad Plan** (est. pre-2004): Iran's nuclear weapons program, led by Mohsen Fakhrizadeh. Included EMP weapon research as cover for nuclear weapons development.
- **SPND** (est. 2011): Successor to Amad Plan, established by Fakhrizadeh. Has contractual cooperation with 100 universities and 1,200 knowledge enterprises.
- **Sanjarian site** (est. 2003): Former Amad Plan site for multipoint initiation (MPI) systems for spherical implosion. Renewed SPND activity reported in 2024.
- **Golab Dareh site** (est. 2003): Former Amad Plan site for nuclear weapons development. Renewed SPND activity reported in 2024.

The renewal of activity at Sanjarian and Golab Dareh sites in 2024 is concerning, as these facilities were central to the Amad Plan's nuclear weapons development work. However, the renewed activity is associated with SPND's nuclear weapons research, not plasma weapons development. The connection between SPND and Iran's plasma physics research community — through university contracts with Sharif, Imam Khomeini, and Amirkabir universities — creates a potential pathway for dual-use technology transfer, but no evidence of actual plasma weapons development has been identified.

Confidence: Established (nuclear lineage); Unsupported (plasma weapons connection). The Amad Plan-SPND nuclear weapons lineage is **Established** through IAEA documentation and intelligence reporting. The renewed activity at Sanjarian and Golab Dareh is **Strongly inferred** from intelligence sources. However, any connection between this nuclear weapons lineage and plasma orb weapons development is **Unsupported** — no evidence links SPND's nuclear activities to plasma weapons.

3.5 Regional Proliferation: Hezbollah and Proxy Networks

Hezbollah (est. 1985) is the Lebanese militant organization that reportedly received electromagnetic warheads from IRGC Quds Force in September 2024. This transfer represents Iran's most documented act of directed energy technology proliferation to a proxy group. The electromagnetic warheads are conventional EMP devices, not plasma weapons, but the transfer demonstrates Iran's willingness to proliferate directed energy technology within its regional network.

Key relationships:

- IRGC **provided warheads to** Hezbollah (2024)
- Hezbollah **received warheads from** IRGC (2024)
- Electromagnetic warheads **transferred to** Hezbollah (2024)

Confidence: Strongly inferred. The electromagnetic warhead transfer to Hezbollah is reported by multiple regional intelligence sources but has not been independently confirmed through physical inspection.

3.6 Position in the Global Plasma Weapons Landscape

Iran's position in the global plasma weapons landscape is defined by three factors: its surprisingly extensive civilian fusion research infrastructure, its limited but growing directed energy weapons capability, and its controversial nuclear program with documented weapons aspirations. Despite these factors, Iran has no evidence of plasma orb weapons development.

In relation to the primary programs examined in the main US research paper, Iran's connections are primarily through Russia. The SPND visits to Polyus and Toriy institutes create a potential channel for Russian directed energy technology transfer, though no

evidence of actual plasma weapons transfer has been identified. Iran's connection to China is limited to laser system acquisition, not plasma weapons. Iran has no documented connection to US or Chinese plasma weapons programs.

Assessment: Iran occupies a unique position in the global plasma weapons landscape — a nation with extensive civilian fusion research, limited DEW capability, and a controversial nuclear program, but no evidence of plasma orb weapons development. The SPND visits to Russian directed energy institutes (Polyus, Toriy) in August 2024 represent the most concerning data point, but the purpose and outcomes of these visits remain unknown. Iran's fusion research appears to be primarily civilian in nature, conducted under AEOI/NSTRI oversight with international engagement through ITER delegation visits. The country's DEW capability is limited to laser dazzling and unverified claims, with no plasma weapons dimension.

Conclusions & Assessment

Conclusions & Assessment

Overall Assessment

This investigation has mapped Iran's plasma physics, fusion research, and directed energy weapons ecosystem through a network graph of 40 entities and 80 relationships. The analysis reveals a nation with an unexpectedly broad plasma physics research infrastructure — five operational tokamaks, ICF and IECF capability, multiple university plasma physics programs — alongside a controversial nuclear program, limited directed energy weapons capability, and concerning but unverified connections to Russian directed energy research institutes. Despite this extensive ecosystem, the investigation finds no evidence of plasma orb weapons development in Iran.

V2 Confidence Framework Assessment

Established Findings

- **Iran operates five tokamaks across multiple institutions.** Damavand, Alvand, IR-T1, Taban, and Alborz are documented in peer-reviewed publications and ITER delegation visit reports from November 2015. *Confidence: Established.*
- **AEOI operates Iran's central plasma physics and fusion research program.** The Plasma and Fusion Research School with its four research groups is documented in AEOI publications and academic literature. *Confidence: Established.*
- **Iran's ICF program uses a 100-joule laser system.** The laser fusion project and IR-IECF device are documented in academic publications. The system is orders of magnitude below weapons-grade ICF facilities. *Confidence: Established.*
- **SPND is the successor to the Amad Plan nuclear weapons program.** SPND's establishment by Fakhrizadeh and its university cooperation network are documented in IAEA reports and intelligence assessments. *Confidence: Established.*
- **SPND visited Polyus and Toriy institutes in Russia in August 2024.** The visits are documented in intelligence reporting. *Confidence: Established.*
- **Iran acquired a Chinese laser counter-drone system.** The system was identified through open-source imagery deployed in Tehran in October 2024. *Confidence: Established.*

- **Iran has no evidence of plasma orb weapons development.** The absence of evidence across all 40 mapped entities and 80 relationships provides strong support for this negative finding. *Confidence: Established.*

Strongly Inferred Findings

- **IRGC provided electromagnetic warheads to Hezbollah in 2024.** Multiple regional intelligence sources report the transfer, though it has not been independently confirmed through physical inspection. *Confidence: Strongly inferred.*
- **SPND has renewed activity at Sanjarian and Golab Dareh sites.** Intelligence reporting indicates renewed activity at former Amad Plan sites in 2024. *Confidence: Strongly inferred.*
- **Iranian university plasma physics programs cooperate with SPND.** Co-authorship patterns and SPND's documented contractual relationships with universities suggest cooperation. *Confidence: Strongly inferred.*

Speculation

- **The Seraj laser weapon is an operational air defense system.** The claim was made through state media but lacks independent verification, technical specifications, or public demonstrations. *Confidence: Speculation.*
- **SPND's visits to Polyus and Toriy involved plasma weapons technology transfer.** The visits are established facts, but their purpose — and whether any technology transfer occurred — is unknown. *Confidence: Speculation.*

Unsupported Claims

- **Iran is developing plasma orb weapons.** No evidence across 40 entities and 80 relationships supports this claim. *Confidence: Unsupported.*
- **Iran's tokamak program has weapons applications.** All five tokamaks are small research devices with parameters orders of magnitude below weapons-relevant levels. *Confidence: Unsupported.*
- **Iran's 100-joule ICF laser is a weapons system.** The system produces 100 joules — roughly 18,000 times less than the US National Ignition Facility's 1.8 MJ. *Confidence: Unsupported.*

Final Assessment: No confirmed fielded operational plasma orb weapon, but Iran'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 Ogonek article describing Russian plasmoid weapon tests, and the more speculative MH370 footage showing three luminous orbs in coordinated formation. Iran's specific contribution to this pattern is through SPND nuclear weapons organization visits to Russian plasma institutes (Polyus and Toriy in August 2024), its extensive civilian plasma physics infrastructure (five operational tokamaks, ICF/IECF capability), and limited DEW capability. The SPND visits to Russian directed energy institutes are the most concerning data point and warrant continued monitoring. Iran's fusion research appears to be primarily civilian, conducted under AEOI/NSTRI with international scientific engagement through ITER delegation visits.

Position in the Global Landscape

Iran's position in the global plasma weapons landscape is defined by its relationship to Russia as its primary technology partner, its acquisition of Chinese laser systems, and its isolation from Western fusion research programs due to sanctions. The 40-entity network mapped in this paper represents a meaningful node in the global technology transfer network, particularly through the SPND-Russia connection.

In relation to the primary programs examined in the main US research paper, Iran's connections are primarily through Russia. The Kurchatov Institute-AEOI cooperation agreement and the SPND visits to Polyus and Toriy institutes create potential channels for Russian directed energy technology transfer. However, the publicly disclosed scope of Kurchatov-AEOI cooperation does not include plasma physics, and the purpose of the SPND visits remains unknown. Iran has no documented connection to US or Chinese plasma weapons programs.

Strengths and Limitations

Iran's plasma physics ecosystem demonstrates the following strengths:

- Extensive fusion research infrastructure with five operational tokamaks — more than most developing nations
- ICF and IECF research capability, including a 100-joule laser system and inertial electrostatic confinement device
- Multiple university plasma physics programs with documented research output

- International scientific engagement through ITER delegation visits and IAEA frameworks
- Cooperation agreement with Russia's Kurchatov Institute

The investigation also identifies the following limitations:

- All tokamaks are small research devices, not reactor-relevant machines
- ICF laser system is orders of magnitude below weapons-grade facilities
- Limited indigenous DEW development capability — forced to import Chinese laser systems
- Seraj laser weapon claim is unverified and likely exaggerated
- Sanctions isolation limits access to advanced international fusion research
- No evidence of plasma orb weapons development capability

Open Questions

1. What was the specific purpose of the SPND delegation's August 2024 visits to Russia's Polyus and Toriy institutes, and did any directed energy technology transfer occur as a result?
2. Does the Seraj laser weapon exist as an operational system, or is it a propaganda claim with no basis in demonstrated capability?
3. To what extent does SPND's cooperation with Iranian universities involve plasma physics research with potential dual-use applications, as opposed to purely nuclear weapons-related work?
4. Will Iran's request for ITER Associate Member status be reconsidered if political conditions change, and what would this mean for the internationalization of Iran's fusion research?
5. Could the Kurchatov Institute-AEOI cooperation agreement be extended to include plasma physics, and would this create a pathway for Russian fusion technology transfer to Iran?

Assessment Confidence: This assessment is based exclusively on open-source intelligence. The network graph was constructed from publicly available documents, academic publications, IAEA reports, and news reports. The most concerning finding — the SPND visits to Russian directed energy institutes — is an established fact, but the purpose and outcomes of these visits remain unknown. The absence of evidence for plasma orb weapons development in Iran is classified as **Established** based on the comprehensive search across all 40 mapped entities and 80 relationships, combined with the technical assessment that Iran's fusion research infrastructure is too small-scale for weapons applications. However, the SPND-Russia connection warrants continued monitoring as a potential pathway for future technology transfer.