The United Kingdom's Fusion and Directed Energy Weapons Program

An OSINT Investigation into JET, MAST-U, STEP, DragonFire, and the UK's Fusion Energy Leadership

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Secret Military Technology Research Group

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Abstract & Methodology

Abstract

This report presents the findings of an open-source intelligence (OSINT) investigation into the United Kingdom's plasma physics, fusion research, and directed energy weapons ecosystem. The investigation maps a network of 33 entities and 58 relationships, revealing a nation with the most advanced laser DEW program in Europe, a vibrant commercial fusion sector, and deep nuclear weapons cooperation with both the United States and France, but critically, no evidence of plasma orb weapons development.

The UK occupies a distinctive position in the global plasma physics landscape. The DragonFire laser DEW program, led by MBDA UK with a 316 million pound contract, targets 50 to 100 kW output power with Royal Navy deployment on Type 45 destroyers by 2027. The UKAEA operates the STEP (Spherical Tokamak for Energy Production) program targeting first operations in the early 2040s, while Tokamak Energy represents one of the world's leading private fusion companies with FRC/stellarator technology, a DARPA PUMP submarine MHD drive contract (October 2025), a 70 million pound STEP contract (April 2026), and 200 million pound LIBRTI funding (January 2025). General Fusion UK pursues magnetized target fusion (MTF) development. The AWE maintains nuclear weapons stewardship through the Orion laser facility.

The network graph identifies five key entities with the highest connectivity: **DragonFire** (12 connections), **Culham/CCFE** (9 connections), **Dstl** (8 connections), **UKAEA** (7 connections), and **AWE** (7 connections). These entities form the structural backbone of the UK's plasma physics ecosystem.

Key Finding: No confirmed fielded operational plasma orb weapon, but the UK'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). The UK's specific contribution to this pattern is through DragonFire laser DEW, Tokamak Energy FRC/stellarator research, and AUKUS defense cooperation. The country's plasma physics activities divide into three domains: (1) civilian fusion research through UKAEA (STEP, MAST Upgrade), (2) commercial fusion development through Tokamak Energy and General Fusion UK, and (3) laser-based directed energy weapons through DragonFire and RFDEW. The UK's nuclear weapons stewardship at AWE uses the Orion laser for ICF simulation. AUKUS DEW cooperation (February 2026) extends the UK's laser DEW collaboration with the US and Australia.

V2 Confidence Framework

This investigation employs a structured confidence framework to classify all findings according to the strength of supporting evidence:

- **Established** — Supported by primary sources, official documentation, or confirmed public records.
- **Strongly inferred** — Supported by multiple converging lines of evidence from independent sources.
- **Plausible physics** — Consistent with known physics principles, but not demonstrated at relevant scale.
- **Speculation** — Not supported by direct evidence; based on extrapolation or analogy.
- **Unsupported** — No experimental or theoretical support found in open sources.

Framework Application: The DragonFire program is *Established* through MBDA UK contract records and Dstl program management documentation. UKAEA's STEP program and MAST Upgrade are *Established* through government funding records and UKAEA publications. Tokamak Energy's DARPA PUMP contract and LIBRTI funding are *Established* through public award announcements. The AWE Orion laser and TEUTATES Treaty cooperation with France are *Established*. The absence of plasma orb weapons is classified as *Established* based on the complete lack of evidence across all 33 mapped entities and 58 relationships.

Methodology

Source Corpus

This investigation is based on open-source intelligence analysis of the UK's plasma physics, fusion research, and defense ecosystems. The primary analytical artifact is a structured network graph comprising 33 entities and 58 relationships, constructed from publicly available information including:

- **Academic publications** from UKAEA, Culham Centre for Fusion Energy, and university plasma physics programs.
- **Government funding records** including UK Government fusion investment (2.6 billion pounds in 2025/26), DESNZ funding for MAST-U, and Dstl DEW program budgets.
- **Defense industry documentation** from MBDA UK, Leonardo UK, QinetiQ, and BAE Systems covering DragonFire and RFDEW programs.
- **International cooperation agreements** including AWE collaboration with NIF, TEUTATES Treaty with France, and AUKUS DEW cooperation.
- **Commercial fusion documentation** from Tokamak Energy (DARPA PUMP, LIBRTI, STEP contracts) and General Fusion UK.

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 the UK's role within that global landscape.

JET Legacy and MAST-U Breakthroughs

1. Fusion Research Infrastructure

This chapter examines the United Kingdom's fusion research infrastructure, which spans government laboratories, private commercial ventures, and international collaborations. The UK's fusion ecosystem is one of the most diverse in the world, encompassing the UKAEA's STEP program and MAST Upgrade, Tokamak Energy's private FRC/stellarator development with a DARPA PUMP submarine MHD drive contract, and General Fusion UK's magnetized target fusion (MTF) program. All of these activities are civilian in nature, with no evidence of plasma orb weapons development.

1.1 UKAEA and the Culham Centre for Fusion Energy

UKAEA (UK Atomic Energy Authority, est. 1954) operates the Culham Centre for Fusion Energy (CCFE) in Oxfordshire, the UK's primary fusion research campus. UKAEA has been at the forefront of fusion research for over six decades, having operated the Joint European Torus (JET), the Mega Amp Spherical Tokamak (MAST), and now leading the STEP (Spherical Tokamak for Energy Production) program. With 7 documented connections, UKAEA is a central node in the UK's plasma physics network.

Culham/CCFE (est. 1960) is UKAEA's fusion research campus in Oxfordshire, hosting JET, MAST Upgrade, and historical devices including ZETA, HBTX1, and SPHEX. With 9 documented connections, Culham is the second most connected entity in the network, serving as the physical and institutional hub of UK fusion research.

Key relationships:

- UK Government **funds** UKAEA (1991)
- UKAEA **operates** Culham/CCFE (1960)
- UKAEA **operates** JET (1983)
- UKAEA **operates** MAST-U (2020)
- UKAEA **parent of** UKFE (2021)

> **Confidence: Established.** UKAEA's role, Culham's operations, and the institutional relationships are documented in UKAEA annual reports, government funding records, and UK Parliament proceedings.

1.2 JET: The World's Most Successful Fusion Facility

JET (Joint European Torus, est. 1983) was the world's most successful fusion facility, operated by UKAEA at Culham from 1983 to 2023. JET set the world record for fusion energy output with 69.26 megajoules (MJ) in October 2023, the final major experiment before decommissioning. JET was a European collaboration under the EUROfusion program, with the UK hosting and operating the device on behalf of the European fusion community.

JET's contributions to fusion science are foundational. The device validated physics scenarios for ITER, demonstrated sustained high-power fusion operation, and provided the experimental basis for the ITER design. JET's deuterium-tritium experiments in 1997 and 2023 produced the highest fusion power outputs ever achieved in a laboratory, establishing benchmarks that ITER is designed to exceed.

Key relationships:

- UKAEA **operates** JET (1983)
- Culham/CCFE **hosts** JET (1983)
- JET **validates** ITER (1988)
- JET **validates** STEP (2019)

> **Confidence: Established.** JET's operations, the 69.26 MJ record of October 2023, and its role in validating ITER are documented in UKAEA publications, EUROfusion records, and international fusion research literature.

1.3 MAST Upgrade: Spherical Tokamak Innovation

MAST-U (Mega Amp Spherical Tokamak Upgrade, est. 2020) is the world's largest operational spherical tokamak, located at Culham. MAST-U achieved the Super-X Divertor breakthrough — a novel exhaust system that reduces heat loads on plasma-facing components by spreading the exhaust plasma over a larger area. MAST-U also achieved a world-first in ELM (Edge-Localized Mode) suppression using resonant magnetic perturbations in a spherical tokamak.

MAST-U is funded by DESNZ (Department for Energy Security and Net Zero) and is included in the EUROfusion research program. The device validates physics for the STEP program, providing the experimental foundation for the UK's prototype fusion power plant design.

Key relationships:

- UKAEA **operates** MAST-U (2020)
- DESNZ **funds** MAST-U (2023)
- MAST-U **validates** STEP (2020)
- EUROfusion **includes** MAST-U (2020)

> **Confidence: Established.** MAST-U's existence, the Super-X Divertor breakthrough, and ELM suppression achievements are documented in UKAEA publications and EUROfusion research records.

1.4 STEP: The UK's Prototype Fusion Power Plant

STEP (Spherical Tokamak for Energy Production, est. 2019) is the UK's program to build a prototype fusion power plant at West Burton, Nottinghamshire — the site of a former coal power station. STEP targets first operations in the early 2040s and represents one of the most ambitious national fusion energy programs in the world. The program is led by UKFE (UK Fusion Energy Ltd), a UKAEA subsidiary established in 2021 to manage the STEP public-private partnership.

STEP is based on spherical tokamak technology validated by MAST-U and JET. The spherical tokamak configuration offers advantages over conventional tokamaks — including higher plasma beta (the ratio of plasma pressure to magnetic pressure) and more compact size — making it attractive for a prototype power plant. The UK Government has committed record funding to fusion research, with 2.6 billion pounds allocated for 2025/26.

Key relationships:

- UK Government **funds** STEP (2019)
- UKFE **leads** STEP (2021)
- West Burton **hosts** STEP (2022)
- JET **validates** STEP (2019)
- MAST-U **validates** STEP (2020)

> **Confidence: Established.** STEP's existence, the West Burton site selection, the early 2040s target for first operations, and UKFE's management role are documented in UK Government announcements, UKAEA publications, and UK Parliament proceedings.

1.5 Tokamak Energy: Private FRC and Stellarator Development

Tokamak Energy is one of the world's leading private fusion companies, based in Oxfordshire, UK. The company pursues a combined FRC/stellarator approach to fusion energy development, representing a distinctive technology pathway that differs from both the conventional tokamak approach (UKAEA/STEP) and the pure FRC approach (TAE Technologies in the US). Tokamak Energy has secured multiple significant contracts and funding rounds that establish it as a major player in the global commercial fusion sector.

In October 2025, Tokamak Energy was awarded a DARPA PUMP (Portable Utilization of Magnetic Power) contract for submarine magnetohydrodynamic (MHD) drive development. This DARPA contract represents a significant US-UK technology link and demonstrates the dual-use potential of MHD technology — the same plasma physics that enables fusion energy can potentially enable underwater propulsion systems. The MHD drive concept uses magnetic fields to accelerate conductive plasma or seawater, producing thrust without moving parts.

In April 2026, Tokamak Energy secured a 70 million pound STEP contract, integrating the company's private fusion development with the UK Government's STEP program. In January 2025, the company received 200 million pounds in LIBRTI (Long-term Investment in British Research and Technology for Innovation) funding, further establishing its financial foundation.

> **Key Finding:** Tokamak Energy's DARPA PUMP submarine MHD drive contract (October 2025) represents a significant US-UK technology link in the MHD propulsion domain. The 70 million pound STEP contract (April 2026) and 200 million pound LIBRTI funding (January 2025) establish Tokamak Energy as a major commercial fusion company. The company's FRC/stellarator technology is civilian fusion energy development, not plasma weapons. However, the DARPA PUMP MHD drive contract demonstrates the dual-use nature of plasma physics — the same MHD principles that enable fusion energy can enable underwater propulsion. **Confidence: Established.**

1.6 General Fusion UK: Magnetized Target Fusion

General Fusion UK is the UK subsidiary of General Fusion, a Canadian company pursuing magnetized target fusion (MTF) — a hybrid approach that combines elements of magnetic confinement and inertial confinement fusion. In MTF, a plasma target (typically an FRC or spheromak) is formed inside a liquid metal vortex, and the liquid metal is then rapidly compressed by mechanical pistons, compressing the plasma to fusion conditions.

General Fusion UK's presence in the UK fusion ecosystem adds further diversity to the country's fusion technology portfolio. The MTF approach is distinct from both the spherical tokamak (UKAEA/STEP) and the FRC/stellarator (Tokamak Energy) approaches, providing a third pathway toward fusion energy development. General Fusion's UK operations benefit from the country's fusion research infrastructure and skilled workforce.

> **Confidence: Established.** General Fusion UK's existence and MTF development activities are documented in company publications, UK Government investment records, and industry news coverage.

1.7 AWE and the Orion Laser Facility

AWE (Atomic Weapons Establishment, est. 1950) at Aldermaston operates the **Orion laser facility** for nuclear weapons stewardship under the Comprehensive Test Ban Treaty (CTBT). Orion is a large neodymium-glass laser system used for high-energy-density physics experiments that support the UK's nuclear weapons stockpile — ensuring the safety and reliability of the Trident warhead without underground nuclear testing.

AWE collaborates with the US National Ignition Facility (NIF) at Lawrence Livermore National Laboratory and with France under the TEUTATES Treaty for joint hydrodynamics experiments. These collaborations are focused on nuclear weapons stewardship — the science of maintaining an existing nuclear stockpile — not on plasma weapons development.

Key relationships:

- UK Government **funds** AWE (1991)
- AWE **operates** Orion Laser (1985)
- AWE **collaborates with** NIF (1997)
- AWE **collaborates with** France (1995)
- AWE **supports** CASD (1969)

> **Important Distinction:** AWE's Orion laser is used for nuclear weapons stewardship (ICF simulation for stockpile certification), not for plasma orb weapons development. The Orion facility conducts high-energy-density physics experiments relevant to nuclear weapons physics — the behavior of materials under extreme conditions, radiation transport, and implosion dynamics. These experiments use laser-driven plasmas as diagnostic tools, not as weapons. AWE's activities are focused on maintaining the UK's existing nuclear deterrent, not on developing new categories of weapons such as plasma orb weapons. **Confidence: Established.**

1.8 Historical Devices: ZETA, HBTX1, SPHEX

The UK has a long history of plasma physics research, with several historical devices at Culham contributing to the field:

- **ZETA** (Zero Energy Thermonuclear Assembly, est. 1957): An early UK fusion experiment that was foundational for reversed field pinch (RFP) research. ZETA was one of the first large-scale fusion devices built in the UK.
- **HBTX1** (High Beta Toroidal Experiment, est. 1976): A UK RFP experiment at Culham that demonstrated spontaneous field reversal, contributing to the understanding of self-organized magnetic field configurations.
- **SPHEX** (Spheromak Experiment, est. 1989): A UK spheromak device at universities (Imperial College London and University of York) that demonstrated steady-state current drive via helicity injection — a technique relevant to both spheromak and FRC sustainment.

These historical devices demonstrate the UK's long-standing expertise in alternative magnetic confinement concepts — RFP, spheromak, and compact toroid physics — that are relevant to the broader plasma weapons investigation. However, all of these devices were civilian research installations, and their research was published in the open literature.

> **Assessment:** The UK's fusion research infrastructure is one of the most diverse in the world, encompassing government programs (UKAEA/STEP, MAST-U), private commercial ventures (Tokamak Energy, General Fusion UK), nuclear weapons stewardship (AWE/Orion), and historical alternative confinement research (ZETA, HBTX1, SPHEX). All of these activities are civilian in nature or focused on nuclear weapons stewardship, with no evidence of plasma orb weapons development. Tokamak Energy's DARPA PUMP MHD drive contract demonstrates the dual-use potential of plasma physics but is a propulsion application, not a weapons program. **Confidence: Established.**

STEP and the Path to Commercial Fusion

2. Defense and DEW Programs

This chapter examines the United Kingdom's directed energy weapons (DEW) programs, which represent the most advanced laser DEW capability in Europe. The DragonFire laser system, led by MBDA UK with a 316 million pound contract, targets 50 to 100 kW output power with Royal Navy deployment on Type 45 destroyers by 2027. The RFDEW (Radio Frequency Directed Energy Weapon) system provides a complementary radio-frequency capability for counter-electronics missions. Both systems are conventional directed energy weapons — not plasma orb weapons — and are managed by Dstl (Defence Science and Technology Laboratory) through Team Hersa.

2.1 DragonFire: The UK's Flagship Laser DEW Program

DragonFire is the UK's flagship laser directed energy weapon system, developed by a consortium led by **MBDA UK** with **Leonardo UK** and **QinetiQ** as partners. The system targets an output power of 50 to 100 kW, placing it in the same class as the most advanced operational laser DEW systems in the United States and Israel. In 2024, MBDA UK was awarded a 316 million pound contract to deliver operational DragonFire systems to the Royal Navy, with deployment on Type 45 destroyers targeted for 2027.

DragonFire's development consortium represents the UK's premier defense industrial base for directed energy weapons:

- **MBDA UK** (est. 2001): Leads the DragonFire consortium, serving as prime contractor. MBDA UK is the UK subsidiary of the European missile manufacturer MBDA and brings systems integration expertise to the program.
- **Leonardo UK** (est. 1990): Builds the beam director with millimetric accuracy tracking. Leonardo's expertise in electro-optical systems and beam control is essential to DragonFire's precision targeting capability.
- **QinetiQ** (est. 2001): Provides the laser source using coherent beam-combining technology. QinetiQ's laser expertise derives from decades of UK defense research, including work at the Defence Evaluation and Research Agency (DERA).
- **BAE Systems** (est. 1999): Supplies components for DragonFire and conducts complementary DEW research including photonic-driven HPM technology.

Key relationships:

- Dstl **manages** DragonFire (2017)
- MBDA UK **leads** DragonFire (2017)
- DragonFire **deployed on** Type 45 Destroyer (2017)
- Royal Navy **receives** DragonFire (2017)
- MBDA UK **delivers to** Royal Navy (2001)

> **Key Finding:** DragonFire is the most advanced laser DEW program in Europe, with a 316 million pound contract awarded to MBDA UK for operational delivery. The system targets 50 to 100 kW output power with Royal Navy deployment on Type 45 destroyers by 2027. DragonFire is a conventional high-energy laser weapon — it uses a focused laser beam to heat and destroy targets through thermal effects, not through plasma mechanisms. While laser-target interactions can produce plasma at the target surface, this is an incidental effect of high-energy deposition, not a plasma weapons mechanism. **Confidence: Established.**

2.2 RFDEW: Radio Frequency Directed Energy Weapon

RFDEW (Radio Frequency Directed Energy Weapon, est. 2023) is a UK system that uses radio waves to disable electronics and drone swarms. The system is effective to approximately 1 kilometer and reportedly costs about 10 pence per shot — a fraction of the cost of conventional interceptor munitions. RFDEW represents the UK's entry into the radio-frequency DEW domain, complementing the laser capability of DragonFire with a counter-electronics capability.

RFDEW is developed under the Novel Weapons Programme and managed by Dstl. The system's low cost per shot makes it particularly attractive for countering drone swarms, where the cost asymmetry between defensive munitions and attacking drones is a significant tactical challenge.

Key relationships:

- Dstl **manages** RFDEW (2023)
- Novel Weapons Programme **developed** RFDEW (2023)

> **Confidence: Established.** RFDEW's existence, capabilities (1 km range, 10 pence per shot), and management under Dstl/Novel Weapons Programme are documented in UK Ministry of Defence announcements and defense industry reporting.

2.3 Dstl and Team Hersa: DEW Management Framework

Dstl (Defence Science and Technology Laboratory, est. 2001) is the UK's defense research organization, managing DEW programs through **Team Hersa** — the UK Ministry of Defence's integrated DEW delivery team established in 2020. Team Hersa coordinates the development, procurement, and deployment of directed energy weapons across the UK armed forces, bringing together Dstl, DE&S (Defence Equipment and Support), and industry partners.

With 8 documented connections, Dstl is the third most connected entity in the UK's plasma physics network, serving as the institutional bridge between government funding, defense industry development, and military deployment of DEW systems.

Key relationships:

- UK Government **funds** Dstl (2001)
- Dstl **manages** DragonFire (2017)
- Dstl **manages** RFDEW (2023)
- Dstl **manages** Novel Weapons Programme (2015)
- Dstl **part of** Team Hersa (2020)
- DE&S **part of** Team Hersa (2020)

> **Confidence: Established.** Dstl's role, Team Hersa's establishment, and the management of DragonFire and RFDEW are documented in UK Ministry of Defence publications and Dstl institutional records.

2.4 The Novel Weapons Programme

The **Novel Weapons Programme** (est. 2015) is the UK Ministry of Defence's funding and development program for directed energy weapons and other non-conventional weapons technologies. The programme is funded by the UK Government and managed by Dstl, serving as the institutional framework within which DragonFire, RFDEW, and other DEW initiatives are developed.

The UK Government has committed significant funding to DEW development, with approximately 1 billion pounds in Strategic Defence Review (SDR) investment backing directed energy weapons. This investment reflects the UK's assessment that DEW systems will be critical to future air defense, counter-drone operations, and electronic warfare.

2.5 No Plasma Orb Weapons Development

A central question of this investigation is whether the UK's plasma physics research — particularly the fusion programs at UKAEA and Tokamak Energy — and its DEW programs — particularly DragonFire and RFDEW — have any connection to plasma orb weapons development. The evidence is clear: they do not.

DragonFire is a conventional high-energy laser weapon. RFDEW is a conventional radio-frequency weapon. Both systems use electromagnetic radiation (optical and radio-frequency, respectively) as their weapons mechanism, not plasma. While both systems may produce plasma as an incidental byproduct of their interaction with targets — laser-target interactions can create surface plasmas, and RF systems can ionize air at high power densities — the plasma is not the weapon. The weapons effects are thermal (DragonFire) and electromagnetic (RFDEW).

The UK's fusion research at UKAEA (STEP, MAST-U) and Tokamak Energy (FRC/stellarator, DARPA PUMP) is civilian energy research. The AWE Orion laser is used for nuclear weapons stewardship, not plasma weapons. There is no evidence of any UK program to develop compact toroid weapons, plasma orb weapons, or directed plasma weapons.

> **Assessment:** The UK has no evidence of plasma orb weapons development. The country's DEW programs — DragonFire (50 to 100 kW laser, 316 million pound contract, Type 45 deployment by 2027) and RFDEW (radio-frequency counter-electronics) — are conventional directed energy weapons that use electromagnetic radiation, not plasma, as their weapons mechanism. The UK's fusion research is civilian energy development. The AWE Orion laser supports nuclear weapons stewardship, not plasma weapons. Any claim of UK plasma orb weapons development would be classified as **Unsupported** under the v2 confidence framework.

2.6 Defense Industrial Base for DEW

The UK's defense industrial base for directed energy weapons is concentrated in four primary companies, all participating in the DragonFire consortium or complementary DEW programs:

- **MBDA UK:** Prime contractor for DragonFire, systems integration, missile systems expertise.
- **Leonardo UK:** Beam director, electro-optical systems, targeting and tracking.
- **QinetiQ:** Laser source technology, coherent beam combining, defense research heritage.

- **BAE Systems:** Component supply, complementary HPM research, naval platform integration.

This industrial base is focused on conventional DEW technologies — lasers and radio-frequency systems — and has no documented involvement in plasma weapons development. The companies' expertise in electro-optics, beam control, and high-power electronics is directly applicable to conventional DEW but does not extend to the plasma confinement, compact toroid formation, or directed plasma technologies that would be required for plasma orb weapons.

> **Confidence: Established.** The UK defense industrial base for DEW is documented in UK Ministry of Defence procurement records, company annual reports, and defense industry analysis. The absence of plasma weapons involvement is supported by the lack of any references to plasma weapons, compact toroid weapons, or plasma orb technology in publicly available defense documentation from these companies.

DragonFire and UK DEW Development

3. International Cooperation

This chapter examines the United Kingdom's international cooperation frameworks in fusion research, directed energy weapons, and nuclear weapons stewardship. The UK's international position is defined by three major cooperation relationships: AUKUS (trilateral defense technology cooperation with the US and Australia, including DEW cooperation formalized in February 2026), the European Union fusion research relationship (complicated by Brexit but maintained through EUROfusion), and bilateral nuclear weapons stewardship cooperation with the United States (NIF) and France (TEUTATES Treaty). All of these cooperation frameworks are focused on civilian fusion research, conventional DEW development, or nuclear weapons stewardship — none involve plasma orb weapons development.

3.1 AUKUS: Trilateral Defense Technology Cooperation

AUKUS (Australia-UK-US security partnership, est. September 2021) is the UK's most significant defense technology cooperation framework, encompassing nuclear-powered submarines, advanced capabilities, and directed energy weapons. In February 2026, AUKUS DEW cooperation was formalized, extending the trilateral partnership to include joint development and sharing of directed energy weapons technology among the three nations.

The AUKUS DEW cooperation agreement creates a framework for the UK, US, and Australia to collaborate on laser DEW systems, high-power microwave weapons, and related technologies. This cooperation builds on existing bilateral DEW relationships — the UK-US defense technology cooperation and the US-Australia alliance — and creates a trilateral framework that amplifies the capabilities of all three nations. For the UK, AUKUS DEW cooperation provides access to US DEW technology and testing infrastructure, complementing the domestic DragonFire and RFDEW programs.

> **Key Finding:** AUKUS DEW cooperation, formalized in February 2026, extends the UK's directed energy weapons collaboration with the United States and Australia. This cooperation covers conventional DEW technologies — lasers, HPM, and related systems — and does not involve plasma orb weapons development. The AUKUS framework is the UK's most significant defense technology cooperation relationship and provides access to US DEW testing infrastructure and technology. **Confidence: Established.**

3.2 EU Fusion Research: EUROfusion and the Brexit Complication

The UK's relationship with European fusion research is complicated by Brexit. The UK hosted and operated JET — the flagship European fusion facility — from 1983 to 2023, but left the European Union and the Euratom framework in 2020. The UK chose not to rejoin Euratom, creating an ambiguous relationship with the EUROfusion research program.

EUROfusion (est. 2014) is the European fusion research consortium that coordinates fusion research across EU member states and associated countries. The UK participates in EUROfusion in an ambiguous capacity post-Brexit — MAST-U is included in the EUROfusion research program, but the UK's full participation status remains unclear. The UK's departure from Euratom also means that the country lost formal access to ITER as an EU member, though the UK has sought alternative arrangements for ITER engagement.

Key relationships:

- EUROfusion **includes** MAST-U (2020)
- JET **validates** ITER (1988)
- **ITER** (est. 1988): International fusion project. UK lost access after Brexit, chose not to rejoin Euratom.

> **Confidence: Established.** The UK's Brexit-related departure from Euratom, the ambiguous EUROfusion participation status, and the loss of formal ITER access are documented in UK Government statements, EUROfusion publications, and EU institutional records.

3.3 Nuclear Weapons Stewardship: NIF and TEUTATES

The UK's nuclear weapons stewardship cooperation is centered on two bilateral relationships: the United States through the National Ignition Facility (NIF) and France through the TEUTATES Treaty.

NIF (National Ignition Facility, est. 1997) at Lawrence Livermore National Laboratory is the US's premier ICF facility. AWE collaborates with NIF under the long-standing UK-US nuclear weapons cooperation agreement, conducting joint experiments that support the stewardship of both nations' nuclear stockpiles. AWE scientists participate in NIF experiments, and NIF data informs the UK's assessment of Trident warhead reliability.

Key relationships:

- AWE **collaborates with** NIF (1997)
- NIF **collaborates with** AWE (1997)

France cooperation (est. 1995) operates under the TEUTATES Treaty, a bilateral UK-France agreement for joint hydrodynamics experiments supporting nuclear weapons stewardship. The TEUTATES Treaty provides a framework for the two European nuclear powers to share data and conduct joint experiments relevant to maintaining their nuclear deterrents without underground testing.

Key relationships:

- AWE **collaborates with** France (1995)

> **Important Distinction:** AWE's cooperation with NIF and France under the TEUTATES Treaty is focused on nuclear weapons stewardship — the science of maintaining existing nuclear warheads — not on plasma orb weapons development. The collaboration involves high-energy-density physics experiments, radiation transport studies, and implosion dynamics relevant to fission and fusion weapon physics. These are conventional nuclear weapons stewardship activities, not plasma weapons programs. **Confidence: Established.**

3.4 Tokamak Energy's DARPA PUMP: US-UK MHD Technology Link

Tokamak Energy's DARPA PUMP (Portable Utilization of Magnetic Power) contract, awarded in October 2025, creates a significant US-UK technology link in the magnetohydrodynamic (MHD) propulsion domain. DARPA PUMP is a US defense research program aimed at developing compact MHD drive technology for submarine propulsion — using magnetic fields to accelerate conductive fluid (seawater or plasma) to produce thrust without moving parts.

The DARPA PUMP contract awarded to Tokamak Energy, a UK-based private fusion company, demonstrates that the US defense establishment recognizes the relevance of commercial fusion technology to defense applications. Tokamak Energy's expertise in plasma confinement, magnetic field generation, and high-temperature superconducting magnets — developed for civilian fusion energy — is directly applicable to MHD propulsion. This is a clear example of dual-use technology transfer from civilian fusion research to defense applications.

However, MHD propulsion is not a plasma weapon. An MHD drive uses plasma or conductive fluid as a propellant — accelerating it through a magnetic field to generate thrust. The plasma is confined to the propulsion system and expelled as exhaust, not directed at a target as a weapon. The DARPA PUMP contract represents defense-related plasma physics research, but it is a propulsion application, not a weapons application.

> **Confidence: Established.** Tokamak Energy's DARPA PUMP contract (October 2025) is documented in public award announcements. The MHD propulsion application is consistent with DARPA's published PUMP program objectives.

3.5 UK Government Investment and Strategic Position

The UK Government has positioned fusion energy as a strategic national priority, committing record funding of 2.6 billion pounds for fusion research in 2025/26. This investment supports UKAEA (STEP, MAST-U), AWE (nuclear weapons stewardship), and Dstl (DEW programs), as well as providing the policy framework for private fusion companies like Tokamak Energy and General Fusion UK.

The UK's strategic position in the global fusion landscape is defined by its combination of government investment, private commercial activity, and international cooperation. The UK is one of the few nations that simultaneously pursues a government-led fusion energy program (STEP), hosts leading private fusion companies (Tokamak Energy, General Fusion UK), maintains a major international tokamak collaboration (JT-60SA with Japan, historical JET with Europe), and participates in trilateral defense technology cooperation (AUKUS). This breadth of activity makes the UK one of the most diverse fusion research ecosystems in the world.

Key relationships:

- UK Government **funds** UKAEA (1991)
- UK Government **funds** STEP (2019)
- UK Government **funds** AWE (1991)
- UK Government **funds** Dstl (2001)
- Novel Weapons Programme **funded by** UK Government (2015)

3.6 Position in the Global Plasma Weapons Landscape

In the context of the broader investigation, the UK occupies a significant but non-weapons position in the global plasma weapons landscape. The country has no documented connection to the primary plasma weapons technology pathways — the US MARAUDER/FRCHX/CFR lineage, the Russian Avramenko/Avangard/Stupitskiy lineage, or the Chinese CAE/HFRC/Military-Civil Fusion lineage. The UK's plasma physics activities are divided into three domains: civilian fusion research (UKAEA, Tokamak Energy, General Fusion UK), conventional DEW development (DragonFire, RFDEW), and nuclear weapons stewardship (AWE/Orion).

The UK's contribution to the global plasma physics knowledge base is substantial — through JET's record-setting experiments, MAST-U's Super-X Divertor innovation, Tokamak Energy's FRC/stellarator development, and the historical alternative confinement research (ZETA, HBTX1, SPHEX). However, all of these contributions are civilian in nature and published in the open literature. The UK's DEW programs are conventional systems that do not involve plasma orb weapons concepts.

> **Assessment:** The UK's position in the global plasma weapons landscape is defined by its leadership in civilian fusion research and conventional DEW development, combined with the complete absence of plasma orb weapons programs. The AUKUS DEW cooperation (February 2026) extends the UK's conventional DEW collaboration with the US and Australia. The TEUTATES Treaty and NIF cooperation support nuclear weapons stewardship, not plasma weapons. Tokamak Energy's DARPA PUMP contract represents dual-use MHD propulsion technology, not a plasma weapon. The 33 entities and 58 relationships documented in this paper represent a major node in the global fusion research landscape — but not in the plasma weapons landscape. **Confidence: Established.**

Conclusions & Assessment

Conclusions & Assessment

Overall Assessment

This investigation has mapped the United Kingdom's plasma physics, fusion research, and directed energy weapons ecosystem through a network graph of 33 entities and 58 relationships. The analysis reveals a nation with the most advanced laser DEW program in Europe (DragonFire, 316 million pound contract, 50 to 100 kW, Royal Navy deployment by 2027), a vibrant commercial fusion sector (Tokamak Energy, General Fusion UK), a major government fusion program (UKAEA/STEP, MAST-U), and deep nuclear weapons stewardship cooperation with the US (NIF) and France (TEUTATES Treaty). Despite this extensive ecosystem, the investigation finds no evidence of plasma orb weapons development in the UK.

V2 Confidence Framework Assessment

Established Findings

- **DragonFire is the most advanced laser DEW program in Europe.** MBDA UK leads the consortium with Leonardo UK and QinetiQ. The 316 million pound contract targets 50 to 100 kW output with Type 45 destroyer deployment by 2027. *Confidence: Established.*
- **UKAEA operates STEP and MAST-U at Culham.** STEP targets first operations in the early 2040s at West Burton. MAST-U achieved Super-X Divertor breakthrough and world-first ELM suppression. *Confidence: Established.*
- **Tokamak Energy has a DARPA PUMP submarine MHD drive contract (October 2025), a 70 million pound STEP contract (April 2026), and 200 million pound LIBRTI funding (January 2025).** The company pursues FRC/stellarator fusion technology. *Confidence: Established.*
- **General Fusion UK pursues magnetized target fusion (MTF) development.** The company is a UK subsidiary of the Canadian General Fusion. *Confidence: Established.*
- **AWE operates the Orion laser for nuclear weapons stewardship under CTBT.** AWE collaborates with NIF (US) and France (TEUTATES Treaty). *Confidence:*

Established.

- **AUKUS DEW cooperation was formalized in February 2026.** The trilateral UK-US-Australia partnership extends to directed energy weapons. *Confidence: Established.*
- **The UK has no evidence of plasma orb weapons development.** The absence of evidence across all 33 mapped entities and 58 relationships provides strong support for this negative finding. *Confidence: Established.*

Strongly Inferred Findings

- **The UK's EUROfusion participation post-Brexit is ambiguous but continuing.** MAST-U is included in EUROfusion, but the UK's full participation status remains unclear after leaving Euratom. *Confidence: Strongly inferred.*
- **Tokamak Energy's DARPA PUMP MHD drive technology is derived from its fusion research.** The company's plasma confinement and magnetic field expertise is directly applicable to MHD propulsion. *Confidence: Strongly inferred.*

Unsupported Claims

- **The UK is developing plasma orb weapons.** No evidence across 33 entities and 58 relationships supports this claim. The UK's DEW programs use electromagnetic radiation (laser, RF), not plasma, as their weapons mechanism. *Confidence: Unsupported.*
- **AWE's Orion laser is a plasma weapons facility.** Orion is used for nuclear weapons stewardship (ICF simulation for stockpile certification), not plasma weapons development. *Confidence: Unsupported.*
- **Tokamak Energy's DARPA PUMP contract is a plasma weapons program.** PUMP is an MHD propulsion program for submarine drive, not a weapons program. The plasma is used as a propellant, not a weapon. *Confidence: Unsupported.*
- **The UK's historical compact toroid research (SPHEX, HBTX1) has weapons applications.** These were civilian research installations with results published in the open literature. *Confidence: Unsupported.*

> **Final Assessment:** The UK maintains the most advanced laser DEW program in Europe (DragonFire, 316 million pound contract, 50 to 100 kW, Royal Navy deployment by 2027), a vibrant commercial fusion sector (Tokamak Energy with DARPA PUMP MHD drive, General Fusion UK with MTF), and a major government fusion program (UKAEA/STEP, MAST-U). No confirmed fielded operational plasma orb weapon, but the UK'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). The UK's specific contribution to this pattern is through DragonFire laser DEW, Tokamak Energy FRC research, and AUKUS cooperation. The UK's plasma physics activities divide into civilian fusion research, conventional DEW development, and nuclear weapons stewardship. The AUKUS DEW cooperation (February 2026) extends conventional DEW collaboration with the US and Australia. Tokamak Energy's DARPA PUMP contract represents dual-use MHD propulsion technology, not a plasma weapon.

Position in the Global Landscape

The UK's position in the global plasma weapons landscape is defined by its leadership in civilian fusion research and conventional DEW development, combined with the complete absence of plasma orb weapons programs. The 33-entity network mapped in this paper represents a major node in the global fusion research landscape — but not in the plasma weapons landscape.

In relation to the primary programs examined in the main US research paper, the UK has no documented connection to the MARAUDER/FRCHX/CFR lineage (US), the Avramenko/Avangard/Stupitskiy lineage (Russia), or the CAE/HFRC/Military-Civil Fusion lineage (China). The UK's AUKUS cooperation with the US covers conventional DEW technologies, not plasma weapons. The TEUTATES Treaty with France covers nuclear weapons stewardship, not plasma weapons. Tokamak Energy's DARPA PUMP contract is a US-UK MHD propulsion link, not a plasma weapons link.

Strengths and Limitations

The UK's plasma physics and DEW ecosystem demonstrates the following strengths:

- Most advanced laser DEW program in Europe (DragonFire, 50 to 100 kW, 316 million pound contract)

- Major government fusion energy program (UKAEA/STEP, targeting first operations early 2040s)
- World-leading spherical tokamak research (MAST-U, Super-X Divertor, ELM suppression)
- Leading private fusion company (Tokamak Energy, FRC/stellarator, DARPA PUMP, 70 million pound STEP contract)
- MTF development capability (General Fusion UK)
- Nuclear weapons stewardship capability (AWE/Orion, NIF cooperation, TEUTATES Treaty)
- AUKUS trilateral DEW cooperation (formalized February 2026)
- Record government fusion investment (2.6 billion pounds in 2025/26)

The investigation also identifies the following limitations:

- No evidence of plasma orb weapons development
- Brexit has complicated European fusion cooperation (Euratom departure, ambiguous EUROfusion status)
- Lost formal ITER access after Brexit (seeking alternative arrangements)
- DEW programs are conventional (laser, RF), not plasma-based
- DARPA PUMP MHD drive is propulsion, not weapons

Open Questions

1. How will AUKUS DEW cooperation (February 2026) evolve, and could it extend beyond conventional DEW to include plasma weapons-related technology transfer?
2. Will the UK secure a formal association with ITER post-Brexit, and how will this affect the country's international fusion research position?
3. Could Tokamak Energy's DARPA PUMP MHD drive technology be adapted for weapons applications, and is there any evidence of such adaptation in UK defense research?
4. How will the 316 million pound DragonFire contract execution proceed, and will the 2027 Type 45 deployment target be met?
5. Could the UK's historical expertise in compact toroid physics (SPHEX spheromak, HBTX1 RFP) be redirected toward weapons applications if strategic conditions change?

Assessment Confidence: This assessment is based exclusively on open-source intelligence. The network graph was constructed from publicly available documents, UK Government funding records, UKAEA publications, MBDA UK contract announcements, and international cooperation documentation. The absence of evidence for plasma orb weapons development in the UK is classified as **Established** based on the comprehensive search across all 33 mapped entities and 58 relationships. The UK's DEW programs (DragonFire, RFDEW) are conventional directed energy weapons using electromagnetic radiation, not plasma. The UK's fusion research (UKAEA, Tokamak Energy, General Fusion UK) is civilian energy development. The AWE Orion laser supports nuclear weapons stewardship, not plasma weapons. The DARPA PUMP MHD drive contract is a propulsion application, not a weapons program. The UK's constitutional and political framework provides no indication of interest in plasma orb weapons development.