

Submission to the Joint Standing Committee on Foreign Affairs, Defence and Trade

Inquiry into the Department of Defence Annual Report 2023–24

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Prepared solely for this inquiry. (No prior publication.)

Executive Summary (Accessible Section)

Fusion energy is advancing from lab breakthroughs toward practical systems that could underpin Australia's sovereign energy resilience and future Defence capability. Unlike fission, fusion offers no long-lived waste, no chain reaction, and inherently safe shutdown, and it is not prohibited under Australia's current nuclear settings. For Defence, compact fusion promises:

- Base & data-centre energy hardening: off-grid, cyber-resilient power for critical Defence infrastructure.
- AUKUS propulsion options: a long-horizon alternative to fission reactors for submarines and surface vessels.
- Autonomy at the edge: high-endurance energy for uncrewed systems and sensors.
- Forward/mobile power: containerised generators replacing vulnerable fuel convoys.
- Electrified force: battlefield charging for electric main battle tanks, logistics fleets, and rotorcraft in denied environments.

Technical Annex (Expert Section)

Fusion approaches & fuels

- Magnetic confinement (tokamak/stellarator): steady operation, maturing for grid pilots.
- Inertial confinement (lasers): ignition achieved at LLNL NIF; aligns with Australia's laser strengths and HB11's pathway.
- Hybrid/pulsed concepts: compact designs with potential Defence fit.

Fuels:

- D-T: most mature; neutron-rich.
- p-B11 (HB11): aneutronic (helium only), appealing for compact Defence power if triggered via ultra-fast laser physics.
- D-He3: promising but requires scarce fuels.

Strategic Defence Applications – Fusion for Military Platforms

A. Defence Dome (JORN-anchored integrated defence energy node):

Fusion-powered Defence Dome couples JORN, directed-energy air/missile defence, EW and persistent ISR to an onsite compact fusion generator.

B. Forward bases & mobile power:

Fuel convoys are prime targets; compact fusion reduces risk by providing on-site continuous power.

C. Electrified land forces:

ADF is trialling electrification (Bushmaster ePMV). Fusion reactors can power brigade charging hubs for tanks, IFVs, and logistics fleets, enabling directed-energy and sensor integration.

D. Rotor-wing and UAV operations:

Fusion at forward bases enables rapid charging for e-rotorcraft/UAVs.

E. Maritime propulsion (AUKUS horizon):

Compact fusion offers a non-fissile propulsion pathway for submarines and surface ships.

Recommendations

- 1) Declare fusion a Defence-relevant sovereign technology.
- 2) Establish an AUKUS Fusion Working Group.
- 3) Pilot programs (2026–2030):
 - Defence-estate demonstrator.
 - Forward “fusion hub” trial for EV fleets/UAVs.
 - JORN-adjacent Defence Dome pilot.
- 4) Expand HB11 & universities partnerships (lasers, plasma, materials).
- 5) Develop workforce pathways & ARPANSA-led safety/regulation frameworks.
- 6) Include fusion hubs/autonomous charging in electrification roadmaps and wargames.

Reference Annex (APA7, 19 items)

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