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Sovereign Arsenal of the Isles

What it would take for the United Kingdom to make every energetic material, feedstock and large-calibre round its forces need, for itself and its friends, through a long war in which its own plants are targets.

CORE JUDGEMENT

Defending the realm now means being able to fight, and keep fighting, a war that reaches these islands and the plants that supply them. Allies have changed how they pay for rearmament, and the UK has set the right direction.

At today's war prices the chemistry pays. What private capital will not do is bet that those prices last, or pay for spare capacity that runs only in war. The state should own that estate, on Ministry of Defence land where it can, store what is not worth making, and let competing private operators run it on capped margins with a payback of five years or less.

The recommended plan costs about **£84bn over ten years, three times today's line**, and should be new money. Three-quarters buys stock and plant the country still owns. Spent at home it supports **40,000 to 55,000 skilled jobs a year** and returns 35-50p in every pound to the Treasury within the decade.

SERIES VSR DEFENCE INDUSTRIAL OUTLOOK - PAPER 04

VERSION 3.0 • 17 OCTOBER 2026 BASIS PUBLIC SOURCES AND MARKET INFORMATION

STANDING BASELINE OUTLOOKS 01, 02 AND 03 (JULY TO SEPTEMBER 2026)

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Basis

This paper draws on public sources (government, parliamentary and NATO documents, legislation, audit and committee reports, company disclosures, planning and heritage records, and reputable trade reporting) and on VitalSpec's own market information (see the rule below). It contains no classified material, no national stockpile figures, no formulations, no manufacturing parameters and nothing about weapon design or performance. Missiles appear only as a production and supply-chain question. Planning conversions, such as tonnes of energetic material per round, are for arithmetic, not descriptions of any munition.

Sourced figures carry a superscript that resolves to Annex C; **derived** figures (calculated from sourced ones) and **estimated** figures (reasoned to, and listed in Annex D) are marked as such. **Any figure or factual claim with no citation and no other label is VitalSpec market information:** prices, costs and facts seen in VSR Trading's own market activity or given to it by industry. It cannot be independently checked and is used to calibrate, not to prove. EUR1 = £0.87 and \$1.33 = £1 (estimated).

The subject is the whole sovereign chain: high explosives (RDX and HMX, the main explosives in modern fills, and TNT, trinitrotoluene) and their fills, propellants based on nitrocellulose, every feedstock behind both, the filling and assembly of large-calibre rounds, air-launched munitions, and the energetic supply chain behind missiles. Small arms are out of scope.

DECLARED INTEREST

VSR Trading is the trading name of VitalSpec Rose Trading Limited, a UK defence trading company. VitalSpec is among the UK firms seeking to enter energetics and munitions manufacturing, and could be eligible to operate under the model this paper proposes. Readers should weigh the paper with that in mind.

ESTIMATIVE LANGUAGE

Probability describes how likely something is. Confidence describes how good the evidence is. The two are independent.

PROBABILITY TERM

CONFIDENCE

Remote chance	≤ 5%
Highly unlikely	10–20%
Unlikely	25–35%
Realistic possibility	40–50%
Likely / probably	55–75%
Highly likely	80–90%
Almost certain	≥ 95%

High

Several credible sources agree, or the issuing authority states it directly

Moderate

Credible sourcing with gaps; another reading is possible

Low

Thin or single-source evidence; treat as a planning input

Key judgements

THE QUESTIONS THIS PAPER ANSWERS

QUESTION	WHERE IT IS ANSWERED
Why should the UK plan for a long war that reaches its own industry?	Section 1
What are our allies spending, and how are they paying for it?	Section 2
Where does the UK stand, and what has it already started?	Section 3
What does "100% British" mean link by link, what should be built, and what should simply be stored?	Section 4
How much capacity and stock: for a better-sized military, and for a war?	Section 5
What does it cost, and how should it be paid for?	Section 6
What does UK plc get back, and when?	Section 7
Who should own it and who should run it?	Section 8
Where should it be built, how is it protected, and under which regulator?	Section 9
What energy, tax and protection regime would make it work, and what does it cost the Exchequer?	Section 10
What about tank, naval, mortar, rocket and air-launched munitions, drones and missiles?	Section 11
Who should we sell to, and who gets first call on supply?	Section 12
How do new firms get in, and where should research go?	Section 13
How should government do it, and what would prove us wrong?	Sections 14 to 16

1 **The UK should size its energetics base for a long war that reaches these islands, and build every new plant on the assumption it will be attacked.** HIGH CONFIDENCE

The 2025 National Security Strategy tells government to "actively prepare for the possibility of the UK homeland coming under direct threat, potentially in a wartime scenario"¹. Russia made about seven million rounds in 2025, seventeen times its 2021 output². The attack on industry has already begun. Germany's federal police recorded 321 suspected sabotage cases in 2025 and over 1,000 suspicious drone flights, with military sites and airports the most affected^{3,4}; Poland's Prime Minister blamed Russian services for rail sabotage in November 2025⁵; Estonia attributed an arson attack on a defence firm to Russia in September 2026⁶; and British men were jailed in 2025 for an arson attack carried out for the Wagner Group in London⁷. The design consequence is depth of stock, at least two separate sources for every critical step, protected sites, and the means to rebuild.

2 **Our allies have changed how they pay for rearmament, and the chemistry is where they put state money first.** HIGH CONFIDENCE

Germany amended its constitution so that defence spending above 1% of gross domestic product (GDP) sits outside the debt brake⁸; its core defence budget rises from EUR62bn in 2025 to a planned EUR106bn in 2027 (EUR133bn with its special fund) and EUR180bn by 2030^{9,10}. Poland plans 4.8% of GDP in 2026, over a third of it through an off-budget fund at its state development bank^{11,12}, and has put PLN2.4bn of state money into its state-owned ammunition and TNT makers¹³. France's energetics champion is state-owned¹⁴; Norway paid over NOK1bn for a fifteen-year commitment to keep its artillery capacity¹⁵. Three-quarters of the EU's EUR500m ammunition fund went to powder and explosives¹⁶.

3 **The UK has made the right start. It is about a sixth of the way to the output a better-sized military needs, and nothing now planned closes the gap.** MODERATE CONFIDENCE

The Strategic Defence Review committed £1.5bn and at least six new energetics and munitions factories¹⁷; the Defence Investment Plan sets £11.1bn for weapons and munitions over four years¹⁸; UK Export Finance has added a £50bn defence fund¹⁹; and industry is investing, in 155mm filling in South Wales²⁰ and new propellant capacity in Scotland²¹. But UK 155mm output is about 50,000 rounds a year, a sixth of this paper's better-sized case. The UK has made no ammonia since 2023²², no TNT since 2008²³, and has no identified producer of military nitrocellulose at scale²⁴; it buys its tank ammunition from Germany²⁵; and the factory programme expects exports and civil markets, not the Ministry of Defence, to form the majority of demand²⁶.

4 **At today's war prices the chemistry pays. What the market will not do is bet that those prices last, or pay for capacity that sits idle in peace.** MODERATE CONFIDENCE

A projected UK RDX plant of 4,000 tonnes a year is costed at about £300m and a European nitrocellulose plant of the same size at about EUR400m. At \$50-100 a kilogram the RDX plant earns £150-300m a year and, at the 20-30% margins the market now pays, pays back in three to

ten years (derived); Rheinmetall's ammunition arm earned 29% in 2025²⁷. But a 155mm shell cost about EUR2,000 before 2022 and EUR8,000 at the peak²⁸. Investors will not finance a plant whose payback depends on war prices lasting, and no one will pay to keep surge capacity idle. That is why new European capacity has been built behind long state contracts, state equity or state grants^{13,14,15,29}: the state carries the price and demand risk, and the surge.

5 **A wholly British chain is achievable with serious change, but not everything is worth making. Some feedstocks the Ministry should buy, store and manage instead.**

MODERATE CONFIDENCE

Every step from ammonia to the filled round can be done here; the serious changes are energy, consents, skills and long-term demand. But some feedstocks are cheaper to store than to make. Plants for linter pulp, hexamine, nitroguanidine and the defence share of ammonia would cost £370-620m to make material worth about £21m a year at the better-sized military's volumes; twelve months of it costs the same £21m to buy once (derived)³⁰. With toluene, acetic anhydride, steel and copper added, a Ministry-owned twelve-month reserve costs about £41m and a war-cover reserve about £109m³⁰. The US already plans for energetics in its national stockpile³¹. Cotton cannot be grown here at all: Europe draws about 70% of its linters from China²⁴, and most of Australia's exported cottonseed goes there too³², which the UK could redirect.

6 **Size for two cases, a better-sized military and a long war, and bridge the gap with licensed shell bodies held for filling at home.**

MODERATE CONFIDENCE ON METHOD, LOW ON FIGURES

Better-sized military: about 300,000 155mm-equivalent rounds a year, six times today's output, reached in about seven years only if new loading lines and body supply are built; a reserve of two million rounds; and missiles and interceptors in far greater numbers, weighted to low-cost interceptors. War: about 600,000 rounds a year with two or three hardened sources per step. Until UK lines exist, the UK should license its L15 shell design and stock empty bodies (about £500 each in the UK, \$600 in India) to be filled at home later. That is a bridge, not sovereignty, and the paper says so.

7 **The recommended plan costs about £84bn over ten years, three times today's weapons and munitions line, and it should be new money.**

MODERATE CONFIDENCE ON RANGE, LOW ON POINT

Build the estate for war and buy stock for the better-sized military: about £84bn over ten years, £8.4bn a year, three times the £2.8bn a year in the Defence Investment Plan¹⁸ (derived). The better-sized case alone is about £70bn and a full war footing about £125bn. Better cost data has made the factories cheaper than this series first estimated; the stock, above all missiles and interceptors, is most of the bill. The new money needed is about 0.2% of GDP a year. The estate belongs in NATO's 1.5% resilience element, which expressly includes the defence industrial base³³; the stock is an addition to core spending. Neither should be taken from forces that need their own uplift.

8 **The country gets most of its money back: three-quarters is held as stock and plant, and the Treasury recovers 35-50p in every pound within the decade.**

MODERATE ON ORDER OF MAGNITUDE, LOW ON PRECISION

Under national accounting rules, ammunition and missiles are inventories and weapon systems are fixed assets³⁴; by year ten about £64bn of the £84bn is stock and plant the nation owns (derived). Spent at home, the programme supports 40,000-55,000 direct and supply-chain jobs a year on average and over 70,000 at the peak of the build³⁵, in a sector whose output per worker is a quarter above the UK average³⁶. Tax on wages, spending and profits, plus exports from spare capacity, returns about £29-41bn by year ten, or £24-36bn with no exports at all (derived). Counting the stock and plant, the nation is ahead from the second year and stays ahead, as an accounting view rather than a fiscal-rules one. The energy and tax regime that makes it work costs about 0.04% of the receipts of HM Revenue and Customs (HMRC)³⁷; the programme it makes possible returns six to nine times that in tax (derived).

9 **Public capital, private operators, regulated return: a state-owned estate run by competing private firms that bring the skills, agility and innovation.**

HIGH CONFIDENCE THAT THIS IS ESTABLISHED PRACTICE

The US Army owns its ammunition plants and contracts firms to run them^{38,39}; Australia does the same at Mulwala and Benalla⁴⁰; Norway, Poland, France, Romania and the Czech Republic hold their energetics through state stakes^{13,14,15,41,42}. The Ministry already sets single-source profit from a 9.10% baseline rate⁴³. A capped margin and a five-year payback fit together because the state carries the heavy capital: an operator putting £15m into a £300m RDX plant and earning about 10% on turnover recovers its stake within about a year (derived). The estate cannot be sold, contracts cannot change hands without consent, and no operator may hold every source of a critical step.

10 **Build on Ministry of Defence land first, secure by design, and make the plants safer, not the rules looser.**

MODERATE CONFIDENCE

With sabotage at this scale every private investor will have to build securely; Ministry sites already have perimeters, safety distances and the Ministry of Defence Police, so the extra security layer comes at a lower marginal cost than a greenfield site, though not at none⁴⁴. The Ministry still holds large former explosives sites such as Easttriggs and Longtown^{45,46}; sold sites left unbuilt, such as Trecwn, can be leased back or, if necessary, bought back under defence powers^{47,48}. Crown land in England has a national-importance planning route⁴⁹, and explosives and major-hazard law already accommodates sites under the Secretary of State's control^{50,51}. Continuous-flow manufacture and insensitive fills shrink hazardous inventories and improve hazard classification^{52,53}; the way to faster consents is safer plants.

11 **Energy is the decisive cost, and a ring-fenced defence-critical regime costs the Exchequer very little.**

HIGH CONFIDENCE ON THE FACTS, MODERATE ON THE DESIGN

UK non-domestic electricity was the dearest of fifteen European countries in 2025⁵⁴; an eligible UK industrial user pays about £86/MWh against £60 in Germany and £69 in France⁵⁵; explosives

makers are excluded from the network-charge discount⁵⁶; UK wholesale gas costs three to four times the US price (derived)^{57,58}. Taking designated sites out of carbon pricing and policy levies, letting them generate their own power, and giving them Freeport-style tax reliefs would cost about £0.35bn a year (estimated): 0.04% of HMRC's £966bn receipts, under 0.4% of corporation tax^{37,59}, and it makes possible a programme that brings back £2.0-3.1bn a year in tax (derived).

12 **Cover every nature: every large-calibre round, Guided Multiple Launch Rocket System (GMLRS) rockets, air-launched munitions, drones, two new independent sources for missile energetics and the materials beneath them, and far more interceptors, most of them cheap.** MODERATE CONFIDENCE

120mm tank rounds come from Germany²⁵, and the 2020 partnering arrangement covered Challenger 2's rifled rounds but not the smoothbore rounds of its successor⁶⁰; there is no public evidence of UK 5-inch production⁶¹. British aircraft and helicopters used more than 1,400 precision-guided munitions over Libya in 2011⁶². Missile production needs two new independent British sources: one for nitrocellulose-based solid rocket grains, one for HMX and plastic-bonded warhead fills. Beneath them, the oxidiser for composite motors comes from three single-site Western merchant producers and a captive US line still scaling up, none of them British⁶³. Drones now carry warheads in their millions in Ukraine and Russia^{64,65}, and the estate should plan for them. With a Patriot interceptor costing about \$3m against a \$35,000 drone⁶⁶, and Switzerland told to expect its Patriot systems five to seven years late⁶⁷, the UK should buy interceptors in far greater numbers, most of them from low-cost British designers such as Cambridge Aerospace⁶⁸.

13 **Help re-arm our oldest and truest friends, give them first call on supply, then serve the rest of the non-sanctioned world.** MODERATE CONFIDENCE

Rheinmetall's order book reached EUR80.5bn in June 2026⁶⁹ and buyers wait years for air defence⁶⁷. The Strategic Defence Review puts it plainly: "If we fight together, we should build together"⁷⁰. Our friends are named, not ranked: Portugal, our ally since 1373⁷¹; the Commonwealth and AUKUS (Australia, United Kingdom, United States) partners; the European allies bound to us by recent treaties^{72,73,74,75}; those who fought beside us in Helmand⁷⁶; and the United States, our closest ally, whose own industrial base is large enough to mend itself. An open general licence for treaty partners on the AUKUS precedent⁷⁷, and fast individual licences for everyone else outside the embargo list, under today's criteria.

14 **Let new firms in, and point research at safer, less import-dependent energetics.**

MODERATE CONFIDENCE

The Ministry spends 3.9% of its money directly with small and medium-sized enterprises (derived)⁷⁸, and Parliament has heard that its processes were designed for primes⁷⁹. Entrants range from NiTech Solutions' continuous-flow chemistry⁸⁰ and The Coventry Arsenal's munitions plans⁸¹ to Cambridge Aerospace and Cody Aerospace and Defence in low-cost interceptors and strike^{68,82}. Research should go into plastic-bonded and insensitive fills across all natures, RDX-based propellants that need less cotton-derived nitrocellulose, continuous-

flow manufacture and digital qualification, which the US Army expects to cut live-fire testing by two-thirds by 2035⁸³.

PART I • WHY THIS MATTERS

01 The first duty of the state

Defence of the realm is the first duty of government. For thirty years that duty was met with forces sized for expeditionary operations and an industrial base sized for training and short campaigns. The government's own strategy documents now say plainly that this is no longer enough.

The 2025 National Security Strategy tells government to "actively prepare for the possibility of the UK homeland coming under direct threat, potentially in a wartime scenario"¹. The Strategic Defence Review published three weeks earlier committed the UK to an "always on" munitions pipeline, at least six new energetics and munitions factories and up to 7,000 UK-built long-range weapons, so that the forces can "endure in prolonged campaigns"¹⁷. This paper takes those words at face value and asks what an industrial base built to meet them would look like.

1.1 Russia now

NATO's Secretary General said in June 2025 that Russia could be ready to use military force against the Alliance within five years⁸⁴, and in December that "we are Russia's next target"⁸⁵. Russia's industry is on a war footing. Estonian intelligence assesses that it made about seven million rounds in 2025, including about 3.4 million howitzer shells, seventeen times its 2021 output, with several million more supplied by North Korea and Iran². Ukrainian commanders report Russian fire of about 27,000 rounds a day through 2025, down from more than 44,000 a day in mid-2024⁸⁶. Those figures are used here as a measure of what industrial war consumes, not as the planning case: this paper is not about Ukraine.

1.2 The attack on Europe's industry has already started

The war has shown that the factories behind an army are targets: Ukraine has struck Russian propellant plants, and the Tambov powder works was hit in June 2025⁸⁷. The same logic is now being applied to Europe, below the threshold of war. The Center for Strategic and International Studies counts Russia-linked sabotage attacks and plots rising from 3 in 2022 to 12 in 2023 and 34 in 2024, with defence industry among the targets⁸⁸, and Western officials describe a campaign intended to overwhelm Europe's security services^{89,90}.

WHERE**WHAT HAS HAPPENED, 2025–26****Germany**

The Federal Criminal Police Office recorded 321 suspected sabotage cases against critical infrastructure in 2025³ and over 165 more by early September 2026⁹¹. It counted over 1,000 suspicious drone flights in 2025, with military sites and airports most affected and defence manufacturers and ports also overflown⁴, and 93 offences of targeted sabotage against transport, up from 58 in 2024⁹²

Poland

The Prime Minister told parliament in November 2025 that Russian services were behind sabotage of the railway line used to supply Ukraine⁵

WHERE	WHAT HAS HAPPENED, 2025–26
Denmark	Airports, including Aalborg, which is also a military air base, closed repeatedly in September 2025 after drone incursions treated as a hybrid attack ⁹³
Estonia	The government blamed Russia for an arson attack on a military robotics firm in September 2026 ⁶
United Kingdom	Men recruited for the Wagner Group were sentenced in 2025 for setting fire to a London warehouse holding supplies for Ukraine ⁷ ; MI5's Director General says the service is "routinely uncovering attempts by state actors to commission surveillance, sabotage, arson or physical violence, right here in the UK" ⁹⁴

Two conclusions follow for this paper. Every new plant, whoever owns it, must be built and run on the assumption that it will be attacked, in peace as well as war. And land that already has a fence, a police force and safety distances (Ministry of Defence land) is the cheapest place to provide that protection (Section 9).

1.3 China and its partners

The longer-term competitor is China, whose shipbuilding capacity alone is estimated at roughly 230 times that of the United States⁹⁵. China has started to use its control of supply chains against European defence industry directly: in April 2026 it placed seven European defence entities under export controls, in July it added fourteen more including Rheinmetall, and it has refused rare-earth licences to defence end users^{96,97}. Europe relies on China for about 70% of the cotton linters from which military nitrocellulose is made²⁴. A long war involving China and its partners would test supply chains that today run through Chinese ports.

1.4 How deep is the UK's magazine?

The question has been asked in public for some time. The Defence Committee recorded a former Commander of Joint Forces Command saying in 2022 that he would be surprised if the UK had munitions to sustain high-intensity conflict "for more than a week", and General Ben Hodges recounting a 2021 US wargaming exercise in which the British Army ran out of munitions eight days into ten^{98,99}. The Chief of the General Staff told the same committee he expected sufficient stockpiles for a fighting division "within a year or two"⁹⁸. Much has been ordered since. The point for this paper is structural: stocks are drawn down quickly in a peer war, and only industry refills them.

1.5 The planning case

This paper therefore sizes the UK's base for a multi-year war, possibly in more than one theatre, in which UK and allied plants are attacked, supply routes are cut and allies are themselves short. That case drives six design principles, used throughout:

PRINCIPLE	WHAT IT MEANS FOR THE ESTATE
Depth	Finished stock held in peace to fight the opening months; and twelve to twenty-four months of the feedstocks it is not worth making here, owned by the Ministry and rotated through British makers (Section 4.6).
Breadth	At least two independent sources, on separate sites, for every critical step; three for the steps that take longest to rebuild.
Redundancy and dispersal	No single site whose loss stops national output; spare plant held in reserve; sites spread across the four nations.
Protection	Secure by design from the first drawing: physical and cyber protection, insurance and rebuild plans treated as part of the estate, not as an afterthought.
Surge	Capacity that can double output within months, kept warm in peace by exports and stock rotation, and fed from the feedstock reserve if supply lanes are cut, so a surge is not starved of inputs.
Mutual production	Agreements with trusted allies to make for each other when one side's plants are hit.

ADVERSARIAL VIEW: EUROPE CAN SUPPLY US

The case. The European Union now makes more than two million shells a year¹⁰⁰, and the Kiel Institute judges European shell output to be "nearly meeting the requirements" for deterrence¹⁰¹. Britain could buy what it needs from allies more cheaply than it could build it.

Why the paper does not hold it. In a long war every government keeps its own output first, and allied order books are already years long: Rheinmetall's stood at EUR80.5bn in June 2026⁶⁹. The bottleneck has moved from shells to the chemistry behind them: Europe's largest ammunition maker says powder output may need to nearly double to over 20,000 tonnes a year¹⁰², and new powder capacity is sold before it runs¹⁰³. Buying from allies is part of the answer, as mutual production. It is not a substitute for a British base.

02 What our allies are spending, and how

The striking thing about allied rearmament is not only its size. It is that governments have changed the way they pay for it and, where the market would not build, have taken ownership of the chemistry themselves.

COUNTRY	SCALE	HOW IT IS PAID FOR	WHO OWNS THE ENERGETICS
Germany	Core defence budget EUR62bn (2025) ⁹ ; over EUR108bn with the special fund (2026) ¹⁰⁴ ; planned EUR106bn core, EUR133bn with the special fund (2027), and EUR180bn core by 2030 ¹⁰	Constitution amended so defence above 1% of GDP is outside the debt brake ⁸ ; EUR100bn special fund; procurement acceleration law in force February 2026 ¹⁰⁵ ; framework contract for 155mm worth up to EUR8.5bn ²⁹	Private primes on long state framework contracts
Poland	4.8% of GDP in 2026, about PLN194–200bn ^{11,12} ; largest share (EUR43.7bn) of the EU's Security Action for Europe (SAFE) loans ¹⁰⁶	Over a third off-budget through the Armed Forces Support Fund at the state development bank, Bank Gospodarstwa Krajowego ¹² ; special act gave PLN2.4bn of state funding to ammunition makers ¹³	State defence group PGZ (Polska Grupa Zbrojeniowa), including TNT maker Nitro-Chem, which now exports TNT to the United States ¹⁰⁷
France	Military programming law 2024–30 raised to EUR435.7bn; budget EUR50.5bn (2025) to EUR75.7bn (2030) ¹⁰⁸	Multi-year law; EUR500m energetics programme including restarting powder at Bergerac, part EU-funded ¹⁴	Eureenco, state-owned ¹⁴
Norway	Over NOK1bn agreement to multiply artillery shell output ¹⁵	Capacity covenant: production capacity must be kept for at least fifteen years ¹⁵	Nammo, half state-owned; Chemring Nobel expansion part state- and EU-funded ¹⁰⁹
Romania	Over EUR500m powder plant at Victoria ⁴¹	Joint venture with a private prime	51/49 with a state veto ⁴¹
United States	\$18bn fifteen-year plan to modernise 23 organic industrial base sites ³⁸ ; first new TNT plant in decades, \$435m ¹¹⁰ ; \$150m of federal money for a single nitroguanidine plant ¹¹¹	Federal capital; long operating contracts; energetics in the national stockpile plan ³¹	Government-owned, contractor-operated plants such as Radford ³⁹
Australia	A\$16–21bn guided weapons and explosive ordnance plan over ten years ¹¹²	Federal capital and long operating contracts	Government-owned Mulwala and Benalla, run by a private operator under an A\$1.1bn contract ⁴⁰
European Union	EUR500m ammunition fund; EUR150bn SAFE loans ^{16,113}	Grants aimed at bottlenecks; common borrowing lent on to states	Three-quarters of the ammunition fund went to powder and explosives ¹⁶

Three patterns stand out. **First, the chemistry gets state money.** Where a private prime builds shells on a framework contract, the powder, explosive and TNT plants alongside are almost always state-owned, state-backed or grant-funded. **Second, contracts are long.** Norway's covenant runs fifteen years; Germany's framework runs to the end of the decade; the US plans in fifteen-year blocks. **Third, finance has moved outside the annual budget.** Germany changed its constitution; Poland borrows through its state bank; the EU borrows in common. Speed follows: Rheinmetall's Unterlüß shell plant, designed for 350,000 shells a year, was built in about fifteen months for about EUR500m¹¹⁴.

WHAT THE UK HAS ALREADY STARTED

The UK has moved in the same direction. The Strategic Defence Review committed £1.5bn to an always-on munitions pipeline and at least six new energetics and munitions factories¹⁷. The Defence Investment Plan sets £11.1bn for weapons and munitions from 2026/27 to 2029/30 and commits to at least six new energetics factories by 2030¹⁸. Funding for up to 22 feasibility studies has been announced¹¹⁵. UK Export Finance has added a £50bn Defence Export Fund to its £80bn capacity¹⁹, and the National Wealth Fund's remit now covers defence¹¹⁶. A new industrial electricity scheme starts in 2027¹¹⁷. Sky Sabre air-defence units are being doubled¹¹⁸ and 72 RCH 155 guns ordered¹¹⁹. Industry is investing too. The direction is right. This paper is about the scale and structure needed to finish the job.

03 Where the UK stands

The UK once made everything in this paper. It stopped for reasons that made sense in a world without a peer threat: privatisation, consolidation, a long single-source partnership that bought efficiently at peacetime volumes, and energy costs that made commodity chemistry uncompetitive. The threat has changed. The structure has not yet caught up.

3.1 From sixteen factories to five sites

When Royal Ordnance was privatised in 1987 it had sixteen factories and about 19,000 staff¹²⁰. Over the following two decades the estate was rationalised. The UK stopped making RDX and HMX when ROF Bridgwater was decommissioned in 2008¹²¹; Bishopton, the last nitrocellulose propellant factory, closed around the turn of the century and is now a new town¹²²; and from 2009 the UK bought its gun propellant from Nitrochemie, a Swiss-German supplier¹²³. The long-term partnering arrangement renewed in 2020 covers 39 munition types, about half of general munitions spend by value, and supports about 1,260 direct jobs at five sites¹²⁴. More than 400 types, mainly countermeasures, pyrotechnics and explosives, sit outside it, and it was sized at about 100,000 large-calibre rounds a year across all natures⁶⁹.

The chemistry beneath the factories went the same way. UK chemical output has fallen sharply since 2021 and the industry counts at least 25 site closures^{125, 126}. The last UK ammonia plant closed in 2023²²; Grangemouth stopped refining crude in 2025¹²⁷; the Lindsey refinery closed the same year¹²⁸; and the Mossmorran ethylene plant closed in early 2026, its owner citing the UK "policy environment"¹²⁹.

3.2 What is being built, and how far it gets us

New capacity is coming. The UK's main munitions contractor has invested more than £150m since 2022, says its new filling facility at Glascoed will raise 155mm capacity sixteen-fold, and expects industrial-scale UK explosives and propellant capacity by the end of 2026 from a continuous-flow pilot²⁰. Chemring has finished building a new propellant facility in Scotland and expects production to start in early 2027²¹. Funding for up to 22 feasibility studies was announced in 2025¹¹⁵, although contracting slipped into 2026¹³⁰. New firms are appearing too: The Coventry Arsenal, incorporated in 2025⁸¹, says it has built a new British 155mm fuze.

These are real gains, and they still leave the UK a long way short. UK 155mm output is about 50,000 rounds a year. The better-sized military in Section 5 needs about 300,000, six times as many, and no facility now being built or planned, here or by our suppliers, is designed to take the UK there. The new capacity is also concentrated in few hands and few sites, and none of it yet reaches the feedstock layer.

3.3 The demand question

The Ministry's Energetics Information Notice for the new factories is candid about the model. It says exports and civil markets "are expected to form the majority of the demand signal", that "MoD funding will not form the majority of funding for proposals", and that "further support funding for facilities is

not envisioned", while offering possible help with sites, regulators, export campaigns, energy relief and research²⁶. That is a reasonable way to test the market. Its consequence is that private investors carry the risk of building plants whose demand depends on export orders not yet placed, at prices nobody can promise will last.

BENCHMARK CALCULATION: AT TODAY'S PRICES EVERY STAGE PAYS; AT YESTERDAY'S, THE CHEMISTRY DOES NOT

What a round is worth. In the wartime market VitalSpec observes, a filled and fused 155mm projectile with its primer sells for about EUR2,000, a full modular charge for about \$4,500, and the complete round for about EUR6,200; an empty shell body costs about £500 to make in the UK. So about two-thirds of a round's value is the propelling charge, a quarter is fill, fuze and assembly, and a tenth is steel (derived). US high-zone 155mm charges use triple-base propellant¹³¹, and in US budget data for 2012-13 the propellant itself is about half the cost of a high-zone charge, the rest being combustible cases, igniters and assembly¹³²; propellant alone is therefore roughly a third of the round (derived). The chemistry is still most of the money.

What the plants cost. A shell-loading line costs about EUR2,500 per round of annual capacity (comparator projects, Annex B). A European nitrocellulose plant of 4,000 tonnes a year costs about EUR400m and a projected UK RDX plant of the same size about £300m; a powder and charge plant costs about EUR140,000 per annual tonne¹³³ (derived).

Payback at today's prices. A loading line costs about 0.4 times a year's revenue and pays back in about two years at a 20% margin. A full propellant chain, from nitrocellulose to finished charges, costs about 0.6 times a year's charge sales and pays back in about three years. An RDX plant pays back in three to ten years at the 20–30% margins the market now pays (all derived).

Payback at yesterday's prices. NATO's most senior military officer said a 155mm shell rose from about EUR2,000 to EUR8,000 after 2022²⁸. If prices fall back to a third of today's, the loading line takes six years at a 20% margin, and the propellant chain ten years at 20% and nearly twenty at 10% (derived). Spare capacity that runs only in war earns nothing at any price. That, not the chemistry, is why every European chemical-stage build this series has reviewed carries state equity, grants or a long state contract^{13,14,41,42,109}.

04 What 100% British means

This paper argues for a wholly British chain: every energetic material, every feedstock that is worth making here, and the filling and assembly of every large-calibre round. That is achievable with serious change. For a handful of feedstocks, the sovereign answer is not a factory but a store the Ministry owns and manages.

4.1 Every feedstock, and what is missing

The table shows every input the chain needs, at category level, what the UK has today, the path this paper recommends, and the skills each needs. Formulations and process routes are outside the scope of this paper.

INPUT	USED FOR	UK TODAY	PATH	SKILLS NEEDED
Natural gas	Energy; ammonia	Domestic and imported; among the dearest industrial energy in Europe ⁵⁴	Feedstock at cost inside the regime (Section 10)	Energy and utilities engineers
Ammonia	Nitric acid; ammonium nitrate	None made since 2023; record imports ^{22, 134}	Build: Teesside plant sized for the market	Major-hazard process operators
Concentrated nitric acid	Every nitration step	Weak acid made on imported ammonia ²² ; no merchant supply of defence grades identified (estimated)	Build: cheap, and dangerous to hold in bulk ¹³⁵	Acid-plant operators, corrosion engineers
Sulphuric acid and oleum	Nitrocellulose; TNT	Refinery-linked sulphur supply shrinking (estimated)	Offtake agreements; co-location	Acid handling
Cotton linters and pulp	Nitrocellulose	None; cotton cannot be grown here; Europe draws about 70% of linters from China ²⁴	Store 24 months; buy from Australia; pulp here only at commercial scale ¹³⁶	Pulp and paper engineers
Toluene	TNT	Refining contracting ^{127, 128}	Store by contract at existing terminals; cut the need over time by moving natures to insensitive fills that do not use TNT	Energetic chemists for insensitive fills

INPUT	USED FOR	UK TODAY	PATH	SKILLS NEEDED
Hexamine	RDX and HMX	No UK producer identified ¹³⁷	Store and rotate now; build at commercial scale later	Fine-chemicals operators
Acetic anhydride	RDX and HMX	The UK's acetyls plant at Saltend, Hull, suspended acetic acid production in September 2026; the site also makes acetic anhydride ¹³⁸	Help restart Saltend inside the defence-critical regime; store 12 months meanwhile	Chemical plant operators
Guanidine and nitroguanidine	Triple-base propellant; insensitive fills	No UK maker; one main Western producer ¹³⁹	Store 24 months; build only with an ally (Section 4.5)	Fine-chemicals operators
Insensitive-fill ingredients	Insensitive melt-cast and plastic-bonded fills	No UK producer identified (estimated)	Build within the explosives estate as insensitive fills spread	Energetic chemists
Polymer binders and additives (such as hydroxyl-terminated polybutadiene, HTPB)	Plastic-bonded fills; composite rocket motors	None; few Western producers; a second source for the common binder takes 18-24 months to qualify ¹⁴⁰	Allied supply; second-source qualification; rotated stock	Polymer chemists
Ammonium perchlorate	Composite rocket motors	No current producer in the public record; three single-site Western merchant producers ⁶³ ; the Ministry lists it among nine key energetic materials ^{26, 141}	Allied supply and two years' stock now; build a UK line alongside UK composite-propellant casting, with allied buyers	Electrochemical and milling specialists
Aluminium powder	Rocket motors; some fills	Two UK sources of atomised powder identified, one confirmed as a maker; output and defence qualification unconfirmed ^{142, 143}	Qualify a UK maker on UK motor programmes	Powder metallurgists
Magnesium, titanium and boron powders	Igniters; pyrotechnics; ramjet fuels	None; China makes about 85-90% of primary magnesium and about 70% of titanium sponge ^{144, 145}	Store; buy from non-Chinese sources	–

INPUT	USED FOR	UK TODAY	PATH	SKILLS NEEDED
Fibres for nozzles and cases	Rocket motors	None; the US buys aerospace-grade rayon fibre for all its services from a single source ¹⁴⁶ ; no end-to-end UK production of advanced fibres ¹⁴⁷	Allied agreements and shared stock	Composites engineers
Magnets, gallium, germanium, antimony	Fins, actuators, seekers, primers	China dominant and bars defence end users ¹⁴⁸	Store; diversify; plan for US rules from 2027 ¹⁴⁹	–
Stabilisers	Propellant shelf life	No UK producer identified (estimated)	Store	–
Steel and copper	Shell bodies; driving bands	UK bodies about £500 each	Store billet and empty bodies	Forging and machining
Fuzes, primers and initiators	Every nature	Partial; The Coventry Arsenal ⁸¹ reports a new British 155mm fuze	Second British source	Precision engineering, electronics

Read across, the gaps fall into three groups. The bulk chemicals (ammonia, concentrated acids) are worth making here, and need cheap energy. The specialist intermediates (linters, hexamine, nitroguanidine, stabilisers) are needed in small volumes and are cheaper to store than to make (Section 4.6). And the missile-specific materials are the thinnest layer of all: the oxidiser, the binders, the metal powders and the fibres for nozzles and cases come from a handful of foreign plants, most of them single sites (Section 11.4). The scarcest skills across all three are nitration and process-safety chemists, chemical engineers, explosives technicians and inspectors (Section 13).

4.2 Ammonia should be British again

Ammonia sits under the whole nitrogen chain: nitric acid, and through it nitrocellulose, RDX, HMX and TNT, as well as fertiliser and mining explosives. The UK's last ammonia plant, at Billingham, closed in 2023. Its owner cited "projected high natural gas prices in the United Kingdom relative to other regions" and "the impact of carbon costs"²². Nitric acid and ammonium nitrate production continue on imported ammonia; imports reached a record 277,000 tonnes in 2023¹³⁴.

Defence alone needs only a small share of a modern plant's output (estimated), so a plant sized to replace imports, at roughly 300,000 tonnes a year on Teesside (estimated), would serve defence, farming and mining together. The economics turn on gas and carbon. A gas-based plant uses about 32 gigajoules of gas per tonne and emits about 1.8 tonnes of carbon dioxide, against 2.4 on the global average¹⁵⁰. At UK wholesale gas of about £27–34/MWh (79.5p a therm in October 2025⁵⁷; range estimated) that is £240–300 of gas per tonne, against about £80 at the US price⁵⁸, and the UK carbon price adds a further £86–115 a tonne (derived). From January 2027 the UK carbon border charge will apply to imported ammonia and nitric acid¹⁵¹, which narrows the gap from the other side. Inside the defence-critical regime in Section 10, with carbon costs removed and a state price backstop if needed,

a British ammonia plant is viable. Outside it, it is not. Until it runs, the defence share should be held as a contracted stock at an existing import terminal³⁰.

4.3 Cotton: the one thing these islands cannot grow

Military nitrocellulose is made from cotton linters, the short fibres left on the seed after ginning, and Europe draws about 70% of them from China²⁴. The UK cannot grow cotton, so sovereignty here means control rather than cultivation: linter stock owned in the UK, pulping in the UK once there is commercial volume, and supply from a trusted grower.

Australia, an AUKUS partner, is the obvious one, and there is a trade to turn around. Before 2020 over 65% of Australia's cotton went to China¹⁵²; since China's informal restrictions Vietnam has headed the list of buyers, with China still among the top five¹⁵³. The bigger prize is the seed, which is where the linters are: in the first half of the 2023 season Australia shipped 665,000 tonnes of cottonseed, nearly 500,000 of them to China³². A long-term UK offtake for delinted Australian linters would give Australia a market that cannot be switched off for political reasons, and give the UK a source that does not run through China.

4.4 The refinery and acetyls problem

Several inputs come from refining and petrochemicals, aromatics for TNT and sulphur for sulphuric acid among them. UK refining is contracting: Grangemouth stopped processing crude in 2025, with about 400 direct jobs lost and up to 2,800 supply-chain jobs forecast to be at risk¹²⁷, and Lindsey, then one of Britain's five remaining refineries, closed the same year¹²⁸. The answer is long-term offtake agreements with the remaining refineries for the small volumes defence needs, contracted stock in existing terminal tanks, and a requirement in the estate contracts that these inputs be secured before a plant is commissioned (estimated).

The acetyls chain is going the same way. In September 2026 INEOS suspended acetic acid production at Saltend, Hull, which INEOS describes as Europe's last remaining world-scale acetyls plant, blaming UK gas prices; the site also makes acetic anhydride, which RDX and HMX production needs¹³⁸. Government should help restart it, with the defence-critical regime in Section 10 applied to the plant as a designated feedstock site, so that the UK keeps its own supply. Until it restarts, the defence need should be held in the feedstock reserve (Section 4.6).

4.5 Guanidine: can we make it here?

Technically, yes. Commercially, not on defence volumes alone. Nitroguanidine is needed for triple-base propellant and some insensitive fills, at about 500 tonnes a year for a better-sized military and 1,500 in war (estimated). There is no UK producer. The main Western source is a single German company, which is expanding and building in the United States¹³⁹, and the US government is putting \$150m into that one plant¹¹¹. A UK plant would cost an estimated £40–80m to make about £4m of material a year³⁰. The pragmatic answer is to hold two years of wetted stock, buy under an allied supply agreement, and build only if UK triple-base and insensitive-fill demand grows, or as a joint plant with an ally.

4.6 The cost of 100%: what to build, and what the Ministry should store

Making every feedstock in Britain sounds like the definition of sovereignty. For some of them it would be a poor use of money. VitalSpec's companion paper on a strategic feedstock reserve tests each one³⁰. For the four where a UK plant is a real option (linter pulping, hexamine, nitroguanidine and a defence-only ammonia plant), the plants would cost about £370–620m between them to make material worth about £21m a year at the better-sized military's volumes. Twelve months of that material costs about the same £21m to buy once. Adding toluene, acetic anhydride, steel and copper brings a twelve-month reserve to about £41m.

ROUTE	UP-FRONT COST	RUNNING COST A YEAR	WHAT IT BUYS
Build every specialist feedstock plant at defence scale	£370–620m	Losses at defence volumes	Made in Britain, but small, idle or uncompetitive plants
Reserve 1: twelve months for a better-sized military	£41m of stock	£6–9m	About 43,000 tonnes: linters, hexamine, nitroguanidine, a terminal stock of ammonia, toluene, acetic anhydride, steel and copper
Reserve 2: war cover	£109m of stock	£17–24m	About 95,000 tonnes: twelve months at war rates, and two years of the single-source items
Fallback: store finished energetics if UK converters are not built	About £470m	Licensed explosives storage	Twelve months of a better-sized military's explosive and propellant

All derived or estimated in the companion paper³⁰; running cost covers storage, finance and the net cost of rotation, and the range depends on whether the state or a private holder finances the stock.

What to build anyway. Nitric acid concentration should be built next to the energetics plants: the plant is cheap, about £11m for 40,000 tonnes a year in Poland, while the acid is toxic and hazardous to hold in bulk¹³⁵. Ammonia should be built for the market as a whole, as above. And the conversion plants themselves must be built: a reserve of linters is no use without a British nitrocellulose plant to turn them into propellant.

Why it has to be the Ministry. Nobody earns a return on stock bought just in case. That is why this is a Ministry of Defence purchase, not a private bet. The model most stockpiling countries use fits: the state owns or finances the stock, a private holder stores and rotates it under contract, and the oldest stock is sold to British energetics makers and civil users before it ages, which gives small firms steady revenue and funds most of the replacement¹⁵⁴. Twelve months is the right first target, longer than Swiss compulsory stocks of three to four and a half months¹⁵⁵ because defence feedstocks have so few suppliers; single-source items should go to twenty-four. The United States already plans this way: its national stockpile plan for 2025 included a ceiling of 20 million pounds of energetics³¹.

Where. Old explosives depots that would cost too much to bring up to modern explosives standards can still store inert bulk goods well. The former Royal Naval Armaments Depot at Trecwn, near

Fishguard, has 58 chambers on a site of over 1,000 acres^{156,157}. On VitalSpec's site figures of about 200 by 70 by 90 feet per chamber, they would give roughly 75,000–97,000 square metres of protected floor (derived, low confidence until surveyed): the first reserve would fill five or six chambers and the second thirteen to seventeen. It is privately owned and needs a survey before it can be priced (Section 9).

4.7 The serious changes

CHANGE	WHY IT IS NEEDED	WHERE
Energy	UK industrial power and gas cost more than competitors'; carbon costs close plants such as Billingham	Section 10
Demand and price risk	Plants pay at war prices but not at peacetime ones; the state must be the anchor customer	Sections 5, 6, 8
Store as well as build	Some feedstocks are cheaper to hold than to make; only the state will pay to hold them	Section 4.6
Land, security and consents	Greenfield explosives sites face long planning, safety-distance and protection problems	Section 9
Skills and regulators	Energetic chemists, technicians and inspectors are scarce after three decades of decline	Section 13
Ownership	Without rules, a consolidated estate can be rationalised again	Section 8

PART II • WHAT IT TAKES

05 How much: a better-sized military, and a war

There are two questions, and they give different answers. How much does a better-sized British military need in peacetime, including a reserve to fight the opening months of a war? And how much capacity does the country need to sustain a long war in which plants are lost? The estate should be built for the second and the stock bought for the first.

5.1 The starting point

UK 155mm output is about 50,000 rounds a year; the partnering arrangement was sized in 2020 at about 100,000 large-calibre rounds a year across all natures⁶⁰. The Army retired its AS90 guns after giving 32 to Ukraine and relies on 14 interim Archer systems¹⁵⁸ until 72 RCH 155 guns arrive from 2028¹¹⁹, which is the number the Royal United Services Institute (RUSI) called the minimum credible force in 2019¹⁵⁹. The Army's M270 rocket launchers are being upgraded to a fleet of 61¹⁶⁰. Regular Army strength was 73,660 in July 2026¹⁶¹, with a plan to grow to 76,000¹⁸. Sky Sabre air-defence units are being doubled¹¹⁸.

5.2 Two cases and a recommendation

MEASURE	A: BETTER-SIZED MILITARY	B: WAR FOOTING	BASIS
155mm-equivalent capacity (rounds a year)	300,000	600,000	A: six times today's output. B: about a sixth of Russia's 2025 howitzer output of 3.4m ² , rounded up from the UK's 13–15% share of European NATO's economy to allow for plants lost in war (derived)
Energetic material, each of propellant and high explosive (tonnes a year)	~7,000	~12,000	About 10 kg of each per round-equivalent, plus other natures, rockets and margin (strategic conversion, estimated)
155mm-equivalent reserve	2.0m	3.5m	B approaches the UK's 3.9–4.5m share of the series' 30m European floor ¹⁶² (derived); both after training use
Empty L15 bodies held for filling	0.5m	1.0m	Bridge until UK lines reach full rate (Section 5.3)
Long-range weapons	7,000	10,000	A: the Strategic Defence Review's own figure ¹⁷
High-end interceptors	4,000	8,000	Estimated; no public baseline
Low-cost interceptors	30,000	80,000	Estimated; against drones and cruise missiles (Section 5.4)

MEASURE	A: BETTER-SIZED MILITARY	B: WAR FOOTING	BASIS
Air-launched munitions (bombs and missiles)	£3bn	£6bn	Estimated (Section 11.2)
Sources per critical step	2	2–3, hardened	Planning case, Section 1
Dispersal and redundancy premium on capital	30%	60%	Estimated

The recommendation: build for war, buy for a better-sized military. Building the estate to Case B but buying stock at the Case A pace leaves about 300,000 rounds a year of spare capacity from year seven (derived). In peace that capacity is sold to friends, which keeps lines and people warm and halves the standing fee for idle plant. In war it comes home, doubling national output in months rather than years. This paper calls that Case R. Its value lies in warm lines and surge; export income is a bonus that depends on prices (Section 7).

5.3 The path from 50,000 to 300,000, and the bridge

Nothing now built or planned takes the UK to 300,000 rounds a year. The ramp below assumes new loading lines from year four and a second source of shell bodies. Even at full rate, a plant fills a reserve only with what is left after training use, which this paper puts at about 50,000 rounds a year.

YEAR	1	2	3	4	5	6	7–10	RESERVE AT YEAR 10
A: made (thousand rounds)	50	60	80	120	180	240	300	1.43m
B: capacity (thousand rounds)	50	70	120	200	320	450	600	2.86m

Estimated. Case A reaches a two-million-round reserve in about year thirteen; Case B reaches 3.5 million in about year twelve (derived). Case R makes rounds for stock at the A pace and exports the difference.

THE BRIDGE: LICENSE THE L15, STORE THE BODIES, FILL AT HOME

The fastest way to buy time is to separate the metal from the chemistry. An empty L15 shell body costs about £500 to make in the UK and about \$600 (£450) in India. Steel bodies are inert, dense and easy to store. The UK should license manufacture of the L15 body to trusted makers at home and abroad, buy 500,000 to a million empty bodies over the first three years (about £0.24–0.47bn, derived), store them, and fill them in British plants as filling, explosive and propellant capacity arrives.

This is a bridge, not sovereignty, and the paper says so: bodies made abroad are imported. But the fill, fuze, propellant and assembly, about 90% of a round's value, would be British, and a stored body is a round that can be completed in weeks rather than ordered from a queue years long. Stored bodies need preservation and inspection, and they become rounds only as fast as the filling lines arrive. Who holds the rights to license the design needs to be confirmed before any contract.

5.4 Missiles and interceptors: more of them, and most of them cheap

Protection of the homeland against missiles and drones is now a mainstream political question. The Conservative Party has proposed a "Britannia Shield" of radars, command systems and interceptors at £10bn over ten years^{163,164}; General Sir Richard Barrons has said that "the cost of an Iron Dome at entry level is probably £80 billion over 10 years"¹⁶⁴; current plans hold about £790m for integrated air and missile defence¹⁸. The threat also goes beyond Russia: ballistic and cruise missiles from Iran and others, and Chinese capability over the longer term.

The numbers matter as much as the money. A Patriot interceptor costs over \$3m against a Russian attack drone estimated at about \$35,000^{66,165}, and allies cannot buy their way to the front of the queue: Switzerland has been told to expect its Patriot systems five to seven years late⁶⁷. So this paper sizes interceptors at far greater numbers than today, weighted heavily to low-cost types: 34,000 in Case A and 88,000 in Case B, of which about nine in ten are low-cost (estimated). British firms are building exactly these. Cambridge Aerospace's Skyhammer is designed to counter one-way attack drones and has been deployed with UK forces and Gulf partners since April 2026⁶⁸; the Ministry has funded three companies for low-cost drone interceptors¹⁶⁶; and Cody Aerospace and Defence, a start-up founded in 2026, is designing a containerised strike missile to be built in a UK factory⁸². The UK should back them with long production contracts rather than one-off development grants.

BENCHMARK CALCULATION: MISSILES AND INTERCEPTORS

Identifiable missile and air-defence lines in current public plans come to about £1.3bn a year: £790m for homeland air, drone and missile defence, £400m for air-defence command and sensors, over £750m for counter-drone, £190m for short-range ballistic missiles and over £350m to double Sky Sabre, all over four years^{18,118}, plus the ten-year £6.5bn complex weapons portfolio¹⁶⁷ (derived; other lines are not broken out). Case A sizes the missile and interceptor stock at about two and a half times that, £31bn over ten years: 7,000 long-range weapons at about £1.75m each (£12.3bn), 4,000 high-end interceptors at about £2.5m (£10bn), 30,000 low-cost interceptors at about £0.1m (£3bn) and £6bn of short-range and counter-drone missiles. Case B is £55bn. The interceptor spend in Case A, about £13bn plus part of the short-range line, sits between the Britannia Shield's £10bn and General Barrons' £80bn, which also covers radars and command systems. Unit costs are public approximations: Storm Shadow about £2m¹⁶⁸, a Tomahawk Block V about \$2.5m¹⁶⁹, Aster about \$2.9m¹⁷⁰, the PAC-3 Patriot interceptor over \$3m¹⁶⁵ and the Lightweight Multirole Missile about £320,000¹⁷¹. The low-cost figure is a deliberately high planning figure: the makers do not publish prices. These are stock-planning figures, not statements of military requirement.

06 The cost, and how to pay for it

The recommended plan costs about £84bn over ten years, three times today's weapons and munitions line. It should be new money, not taken from forces that need their own uplift.

TEN-YEAR COST, £BN (ESTIMATED)	A: BETTER-SIZED	R: RECOMMENDED	B: WAR FOOTING
Shell loading, assembly and packing lines	0.7	1.3	1.3
Propellant chain: nitrocellulose, powder and charges	1.5	2.5	2.5
High explosive: RDX, HMX, TNT and fills	0.5	0.9	0.9
Feedstocks, including ammonia and acids	0.6	0.8	0.8
Missile energetics and materials: two new sources, oxidiser, qualification	1.5	2.5	2.5
Other natures and fuzes	1.5	2.5	2.5
Dispersal and redundancy	1.9	6.3	6.3
Test, evaluation and licensed storage	3.0	5.0	5.0
Estate capital	11.1	21.8	21.8
155mm-equivalent reserve, including licensed bodies	7.4	7.4	14.8
Other natures	5.0	5.0	8.0
Air-launched munitions	3.0	3.0	6.0
Missiles and interceptors	31.2	31.2	55.5
Feedstock reserve: stock plus two years' running cost (Section 4.6)	0.06	0.06	0.15
Stock	46.7	46.7	84.4
Standing-capacity fees	3.5	3.7	7.4
Energy, tax and insurance regime (revenue forgone)	2.5	3.5	3.5
Skills, regulators, research and digital qualification	6.0	8.0	8.0
Total over ten years	69.8	83.7	125.1
Per year	7.0	8.4	12.5
Multiple of today's £2.8bn a year weapons and munitions line ¹⁸	2.5×	3.0×	4.5×
New money a year above today's line (share of £3.0tn GDP)	4.2 (0.14%)	5.6 (0.19%)	9.7 (0.32%)

Workings and assumptions at Annexes B and D; rows may not sum because of rounding. The multiple compares the whole programme, including the estate, with today's stock-purchase line; stock alone is 1.7 times (A and R) and 3.0 times (B). Fees in Case R are half the war-case rate because exports keep spare capacity warm.

Two things have changed since this series first costed the estate. Better data on plant costs, from VitalSpec's market work and recent European builds, has made the factories much cheaper: a war-capable estate is about £22bn, not the £38bn first estimated. And interceptors have moved to the centre of the bill. Stock, above all missiles and interceptors, is now more than half the cost. The factories are the cheap part of sovereignty; the magazine is the expensive part.

6.1 What a round costs

Prices observed in the European wartime ammunition market in 2026 give a reality check on the stock line.

ITEM	OBSERVED PRICE	IN POUNDS	WHAT IT TELLS US
Empty 155mm L15 body, UK-made	£500	£500	About the same as India's \$600 (£450): the metal is not where the UK is expensive
155mm projectile, filled and fused, with primer	EUR2,000	£1,740	Fill, fuze and assembly add about £1,240 to the body
Full 155mm modular charge	\$4,500	£3,380	The charge is about two-thirds of the round's value; the propellant in it about half of that
Complete 155mm round	EUR6,200	£5,390	This paper values a UK-built round at £5,000
Complete 152mm round (former Soviet calibre)	EUR2,750	£2,390	Less than half the NATO 155mm price
125mm tank round, high-explosive or anti-armour	EUR3,000–3,600	£2,610–3,130	A floor for the NATO 120mm rounds the UK imports
120mm mortar bomb	EUR600	£520	Mortar bombs are cheap; their volume is the issue
122mm unguided artillery rocket	EUR6,800–7,200	£5,920–6,260	Rockets cost more than shells, before any guidance

At these prices the £5bn "other natures" line in Case A would buy, for example, a million mortar bombs, 300,000 tank rounds, 300,000 light-gun rounds, 25,000 guided rockets and medium-calibre ammunition (estimated mix). It is a sense-check, not a requirement.

What propellant costs, by family. Public per-kilogram prices for military propellant are scarce. These are the points this paper found:

PROPELLANT	MAIN USE	PRICE PER KG	BASIS
Triple-base	High-zone 155mm charges	About £42 (2022)	US Army order for 4.4 million lb at \$110.6m ¹³¹ , about double the 2012-13 price of £18-24 ¹³² . The order was sole-source to a Canadian plant, and the nitroguanidine in it comes from one German maker ¹⁷²
Low-zone charge propellant	Low-zone 155mm charges	About £15 (2013)	US Army budget ¹³² ; triple-base then cost 55% more
All propellant powders	Mixed: single-base, double-base and others	About £21 (2023)	European export average from trade data; low confidence ¹⁷³
Single-base and double-base, including rocket grain	Small arms, tank, mortar; rocket motors	Not published	No public military price found. Likely below triple-base, which carries the costly nitroguanidine (estimated)
Black powder	Igniters and primers	£23 military (2012-13); £36-80 retail (2026)	US Army budget ¹³² ; US retail prices for US- and European-made powder ¹⁷⁴ . About four Western makers, only one of them in North America ^{175,176}
Smokeless powder, retail	Reloading; a ceiling, not a military price	About £81 (2026); £38-44 (2018)	US retail prices ^{177,178}

Converted at \$1.33 = £1 and EUR1 = £0.87. The 2012-13 US budget figures are per unit; the unit is taken to be the pound, as in the Army's 2012 solicitation for the same item. Small-arms ammunition is not a guide to black powder prices: it uses smokeless powder, and its price is mostly brass, bullet, primer and assembly. A Spanish order for Rheinmetall charge modules implies up to about £360 a module¹⁷⁹.

6.2 New money, not a raid on the forces

The Defence Investment Plan already has to fund ships, aircraft, people and the nuclear deterrent. Taking this programme out of it would weaken the forces it is meant to sustain. The forces need their own uplift, on top of this. The UK has committed to 3.5% of GDP on core defence and up to 1.5% on resilience and security by 2035¹⁸⁰, and NATO's text puts strengthening the defence industrial base inside the 1.5%³³. This paper's recommendation is:

ELEMENT	HOW IT SHOULD BE PAID FOR
The estate: capital, standing fees, regime, skills	A new, ring-fenced resilience line within NATO's 1.5%, treated as long-lived national infrastructure, financed through the National Wealth Fund and Treasury capital ¹¹⁶ , paid through a regulated capacity payment from the Ministry, with the independent cost scrutiny used for Sizewell C and the Thames Tideway Tunnel ^{181,182}

ELEMENT	HOW IT SHOULD BE PAID FOR
The stock: reserve rounds, missiles, interceptors, feedstock reserve	An addition to the core defence budget above today's plan, not a transfer within it
Export buyers	UK Export Finance, including the new Defence Export Fund ¹⁹

6.3 The price of insurance

This paper values a UK-built round at the market price of its parts, about £5,000. Whether British plants can make it at that price depends on the energy regime in Section 10; inside that regime, at today's prices, there is no premium against the EUR6,200 the market charges. The premium appears if prices fall. If allied rounds fall back to EUR3,000–4,000 and a British round still costs £5,000, the premium is £1,500–2,400 a round, or £2.2–3.4bn on Case A's reserve over ten years (derived). It sits in fill and propellant, where energy costs bite, not in the steel. The first time the UK has to buy in a crisis, at crisis prices and the back of the queue, the premium is paid back.

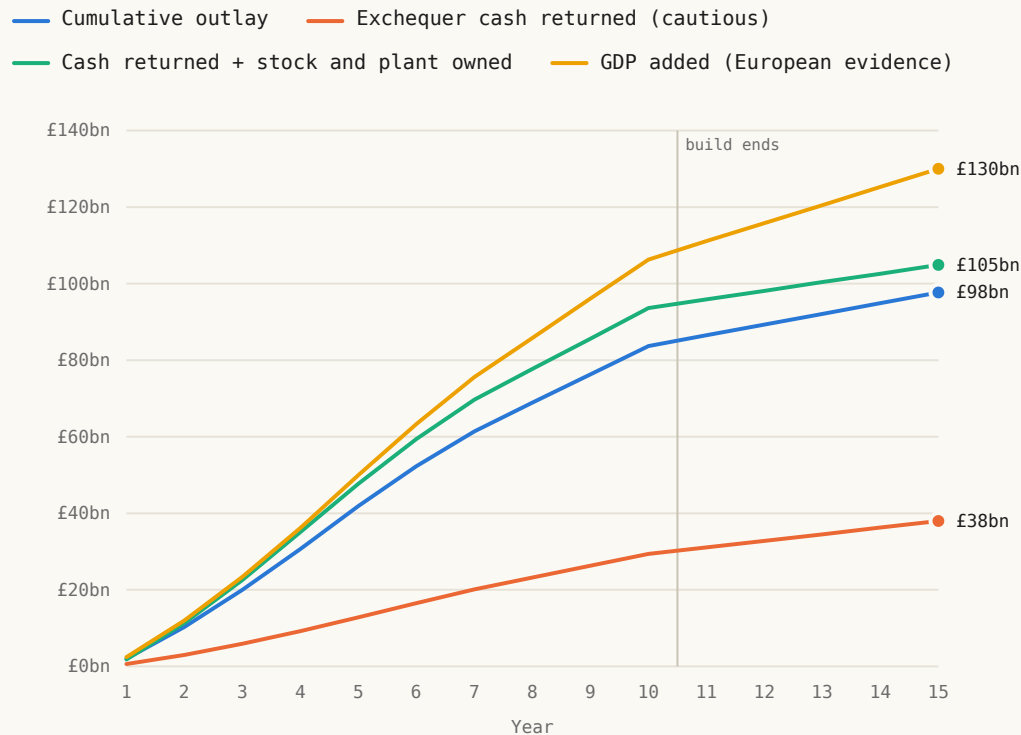
ADVERSARIAL VIEW: THE MONEY WOULD BE BETTER SPENT ON PLATFORMS

The case. Ships, aircraft and people deter; stockpiles sit in bunkers. Every pound here is a pound not spent on capability the forces are short of. **Why the paper does not hold it.** Platforms without munitions do not deter, and evidence to Parliament's Defence Committee suggested the magazine would be exhausted within about a week of peer war⁹⁸. That is why this paper argues for new money rather than a reallocation. Most of the money also stays on the nation's books: Section 7 shows that three-quarters buys stock and plant the country owns.

07 What UK plc gets back

Spent abroad, defence money buys another country's capacity, employs its workers and pays its shareholders' margins. Spent at home, it builds skills, employs people in places that need work, returns a large share to the Treasury and earns export revenue, and most of it buys things the nation still owns.

Figure 1. Recommended case: what goes out, and what comes back (cumulative, £bn)



Derived; workings below and in Annex B. Cash returned uses a cautious multiplier of 1; GDP added uses 1.5, the European evidence for countries that import little¹⁸³. Assets are stock at cost and plant depreciated over thirty years.

7.1 What the chart says

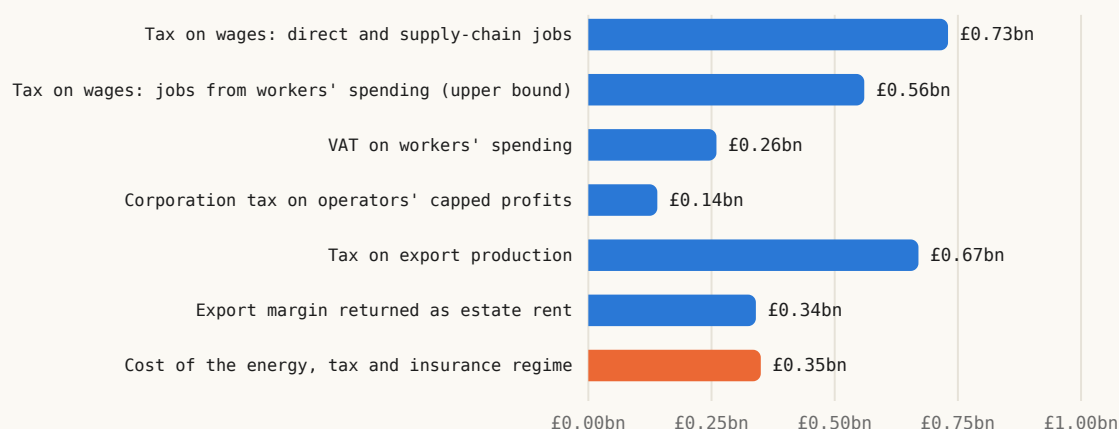
The nation is ahead from year two, and stays ahead. By year ten the programme has cost £83.7bn. It has bought about £64bn of stock and plant that the nation still owns, about 77% of the spend: under national accounting rules ammunition and missiles are inventories, not consumption³⁴. And it has returned about £29bn to the Treasury in tax and estate rent on a cautious view, £41bn on the European evidence. Stock, plant and cash together come to about £94bn, more than the outlay. They exceed it from the second year and stay ahead after the build ends, at about £105bn against £98bn by year fifteen (derived). This is an accounting view, not a fiscal-rules one: stock and plant are non-financial assets and do not reduce borrowing under the Treasury's fiscal rules.

In cash alone, the Treasury does not get it all back, and the paper does not pretend it does. It recovers 35–50p in every pound within the decade, about 28–43p if the export line is left out entirely, and about 40–53p by year fifteen (derived). On the same method most domestic spending returns a

similar share, so the point is the comparison: spent abroad, the same money returns little to the UK economy and almost nothing to the Exchequer. That is the honest version of "it pays for itself": most of the money becomes a magazine and a set of factories the country owns, and a third to a half comes back in cash. The magazine has value only as deterrence, use or sale to friends, so the asset figure is a statement of what the money buys, not a sum the Treasury can bank.

The economy gains more than the programme costs. On the European evidence that a pound of procurement spent in a country that imports little raises GDP by about £1.50¹⁸³, the programme adds about £106bn to GDP in ten years against an outlay of £84bn (derived). On a multiplier of 1 it adds about £74bn. Today some of that money leaves the country: in the twelve months to June 2025 the Ministry placed 174 contracts worth £3bn with suppliers outside the UK, classed by tender address¹⁸⁴.

Figure 2. Where the tax comes from in a typical year, against the cost of the regime (year 8, £bn a year)



Derived, bottom-up, year 8 of the recommended case: about £2.0bn before tax on jobs supported by workers' spending, which uses an older ratio and is an upper bound, and £2.7bn with it, against £3.1bn on the multiplier method used in Figure 1. The orange bar is the annual cost of the energy, tax and insurance regime (Section 10).

7.2 Workings

YEAR	SPEND IN YEAR	CUMULATIVE SPEND	CASH BACK (CAUTIOUS)	CASH BACK (EUROPEAN EVIDENCE)	STOCK AND PLANT HELD	CASH BACK + ASSETS	EXPORTS IN YEAR
1	2.0	2.0	0.6	0.9	1.2	1.8	0.0
2	8.3	10.3	3.0	4.4	8.3	11.3	0.1
3	9.7	20.0	5.9	8.7	16.7	22.6	0.3
5	11.2	41.9	12.8	18.8	34.9	47.7	1.1
7	9.2	61.4	20.1	28.9	49.6	69.7	2.3
10	7.4	83.7	29.4	41.2	64.3	93.6	2.3
15	2.8	97.7	38.0	51.7	66.9	104.9	2.3

fbn, derived. After year 10 the build ends and spending falls to about £2.8bn a year for replenishment, fees, regime and skills. Stock bought after year 10 continues the reserve towards two million rounds and is counted at cost. Cash back = 37% tax take (the Office for Budget Responsibility forecasts 36–38%¹⁸⁵) on the GDP the spend creates (80% UK content × multiplier of 1 or 1.5), plus tax on export production and 15% of export revenue returned as estate rent. Exports = spare capacity (Case B less Case A) × £5,000 a round × 1.5 to allow for energetics and other natures sold alongside.

Checked from the bottom up. In year eight, the programme spends about £5.6bn in the UK. At the ratio implied by the Ministry's employment statistics, about 8,600 jobs per £1bn³⁵, that supports about 48,000 direct and supply-chain jobs, paying about £0.73bn in income tax and National Insurance at an average of about £15,100 a job; the jobs their spending supports (about 65,000 more on an older trade-body ratio¹⁸⁶, an upper bound) pay about £0.56bn; value added tax (VAT) on that spending is about £0.26bn; corporation tax on operators' capped profits about £0.14bn; tax on export production about £0.67bn; and export margin returned as rent about £0.34bn. Total: about £2.0bn before those induced jobs and £2.7bn with them, against £3.1bn top-down (derived).

7.3 Skilled, well-paid work, in the places that need it

Through the build the programme supports about 40,000–55,000 direct and supply-chain jobs a year on average, and over 70,000 at the peak (derived; the lower figure allows for capital-intensive chemistry). Output per worker across aerospace, defence, security and space is about £99,900, roughly a quarter above the UK average³⁶, and chemical workers earn about 25% more than other manufacturing workers and almost 40% more than the average worker¹⁸⁷. The estate's own jobs, several thousand of them, are in the places that lost them; the larger workforce making stock is wherever British firms already build.

AREA (CANDIDATE OR NEARBY SITE)	ECONOMIC INACTIVITY	RECENT LOSS
Middlesbrough and Hartlepool (Teesside)	29.2% / 29.7%	Last UK ammonia plant closed at Billingham, 2023 ²²
Falkirk (Grangemouth)	24.8%	Refinery stopped processing crude, 2025; about 400 direct jobs ¹²⁷
Dumfries and Galloway (Eastriggs)	27.4%	Munitions depot emptied by 2010 and decommissioned ¹⁸⁸
Northumberland (Otterburn, Ridsdale)	26.2%	–
Pembrokeshire (Milford Haven, Trecwn)	24.7%	Trecwn depot closed and sold ¹⁸⁹
Great Britain	21.2%	Grangemouth, Lindsey and Mossmorran together shed about 1,000 direct jobs in under a year ^{127, 128, 129}

Economic inactivity, year to December 2023, Office for National Statistics local indicators¹⁹⁰; the latest consistent local series.

7.4 Margins that come home

Rheinmetall's weapon and ammunition division made an operating profit of EUR1.04bn on sales of EUR3.5bn in 2025, a 29% margin²⁷. Chemring's energetics margin rose from 16.3% to 19.1% in a year, helped by higher prices²¹. Nammo carries an order book of almost four years' revenue¹⁹¹. Every imported round pays a share of that margin abroad. Under a state-owned estate, operators earn a capped return and the margin above it on export sales comes back to the state as rent.

7.5 Wider benefits

The same plants and skills serve much of the civil economy. None of these is the reason for the programme; all of them come with it.

SECTOR	WHAT THE ESTATE GIVES IT
Farming and food	A British ammonia plant restores domestic fertiliser supply and the carbon dioxide food processors rely on: in 2021 the government paid to restart Billingham when two ammonia plants supplying about 60% of UK carbon dioxide stopped ¹⁹²
Mining, quarrying and construction	Ammonium nitrate and commercial explosives from British acid and ammonia
Oil, gas and well services	RDX and HMX for the charges that perforate wells, a civil market of its own
Pharmaceuticals, fine chemicals and coatings	Nitration and acid chemistry, and industrial nitrocellulose for inks and lacquers
Space and advanced engineering	Solid rocket motor and energetic-materials skills shared with the UK's launch and propulsion firms
Chemical clusters	Anchor plants that make Teesside, Grangemouth and the other clusters worth investing in again
Deterrence	A country that can be seen to refill its magazine is less likely to be tested

ADVERSARIAL VIEW: THE MULTIPLIER IS DOING THE WORK

The case. Any public spending has a multiplier; in a tight labour market the true figure may be lower, and capital-intensive chemical plants employ few people. **Response.** Agreed, which is why the cash figure uses a multiplier of 1, the jobs figure is a range, and the paper's headline rests on what the money buys rather than on what it multiplies into. The defensible point is the comparison: the same money spent abroad returns less than a pound to the UK economy¹⁸³. If half the missile and interceptor line is imported rather than a fifth, jobs fall by about 15% and the cautious cash return by year ten to about £26bn (derived).

08 Who owns it, and who runs it

The UK has tried two models: a state arsenal, and a privatised base consolidated into a single long-term partner. This paper recommends a third, which is how the United States, Australia and much of Europe already do it: the state owns the estate, and competing private firms run it. It uses a fourth, capacity covenants, alongside.

OPTION	WHAT IT MEANS	VERDICT
1. Partnering plus grants	Private primes own and run plants; the state adds grants and offtake	Works while prices are high; leaves price risk and surge capacity unfunded (Section 3); concentrates capability in few hands
2. State arsenal	Government owns and runs the plants, as with the Royal Ordnance Factories	Secure but slow, poor at innovation, and hard to recruit for
3. State-owned estate, private operators (recommended)	The state owns land, buildings and heavy plant; competing private firms run them on long operating contracts with a capped return	Public capital where the market will not go; private skills, agility and innovation where it will
4. Grants and capacity covenants (the Norway model)	The state pays a private builder to add capacity and keep it for a fixed term	Buys a first line cheaply, and should be used where a private builder exists. Does not buy a second, separate source, idle surge capacity or protection against a buyer rationalising the base

8.1 How it works

The state owns the hard assets. A publicly owned estate company holds the land, buildings and heavy plant: the expensive, long-lived assets the market will not finance against uncertain prices. It cannot be sold or broken up without Parliament's consent.

Private operators run the plants. Firms from small to mid-sized, not only the largest primes, bid for ten- to fifteen-year operating contracts. They bring the people, the know-how, the working capital and the specialist kit. At least two operators hold the sources of each critical step, so there is always competition and always a second source. Contracts are re-competed on a cycle, so a weak operator can be replaced without losing the plant.

Agility and innovation stay private. Operators keep the know-how they develop and the right to use it in civil markets; they share in export earnings; and they compete for research funding to improve yield, safety and cost. The state buys output and capacity, not inputs.

Returns are capped, and paid back quickly. The Ministry already sets profit on single-source work from a baseline rate of 9.10% for 2026/27, adjusted contract by contract⁴³. Operators earn a capped return of about that order on their costs for UK work and keep a share of export margin. Because the state carries the heavy capital, a capped margin still pays the operator back well inside five years.

BENCHMARK CALCULATION: WHY A CAPPED MARGIN AND A FIVE-YEAR PAYBACK ARE COMPATIBLE

RDX plant. A projected UK plant of 4,000 tonnes a year is costed at about £300m. At \$50–100 a kilogram (estimated) it turns over £150–300m a year. Financed privately at a 10% margin it pays back in ten to twenty years; at the 20–30% margins the wartime market pays, in three to ten. If the state owns the plant and the operator puts in 5%, £15m, a capped margin of about 10% on turnover repays the operator within about a year (derived). That is a high return on a small stake, which is how government-owned, contractor-operated plants work: the operator earns a fee for running the plant, not a return on the state's capital.

Nitrocellulose plant. A European plant of 4,000 tonnes a year costs about EUR400m, about £350m. A Central European nitrocellulose business sold in 2025 earned about £15,500 of operating profit before depreciation per tonne¹⁹³ (derived); on 4,000 tonnes that is about £62m a year, a private payback of about six years at today's margins, and far longer if margins fall back (derived).

Shell-loading line. At about EUR2,500 per round of annual capacity, a £300m line makes about 138,000 rounds a year, worth about £690m at £5,000 a round. An operator putting in 12% pays back in months.

The conclusion. Operators earn a capped margin on their costs and a return on their own working capital, so their stake is repaid well inside five years. The state's capital is not expected to earn a commercial return: it buys deterrence, surge and resilience, and earns the export rent. The regulated-asset discipline of Sizewell C, independent cost scrutiny and an allowed return¹⁸¹, applies; regulated-asset financing, with bill-payers as the source of revenue, does not.

8.2 Precedents

WHERE	MODEL
United States	Army-owned ammunition plants run by contractors under long operating contracts, including Radford ^{38,39}
Australia	Government-owned Mulwala and Benalla run by a private operator ⁴⁰
Norway	Nammo half state-owned; fifteen-year capacity covenant ¹⁵
Romania	Powder plant 51/49 with a state veto ⁴¹
France, Poland, Czech Republic	Eurenco, PGZ and Explosia in state hands ^{13,14,42}
United Kingdom, other sectors	Regulated returns on privately run national infrastructure: Sizewell C and the Thames Tideway Tunnel ^{181,182} ; capped single-source profit rate ⁴³

8.3 Protection against another consolidation

The estate stays public. Operating contracts cannot change hands without the Secretary of State's consent, and a change of control of an operator triggers review and, if needed, re-competition. No operator may hold every source of a critical step. The government holds a special share in the estate company, writes change-of-control rights into every operating contract, and uses the National Security and Investment Act, which received 1,324 notifications in 2025/26¹⁹⁴, to screen ownership. The aim is simple: no single owner should ever again be able to buy the base and rationalise it.

ADVERSARIAL VIEW: CAPPED MARGINS REWARD COST, AND STATE ESTATES OSSIFY

The case. An operator paid cost plus a capped margin earns more by spending more, and a publicly owned estate drifts into the habits of the old arsenals. **Response.** Both risks are real. Prices are benchmarked against European comparators, costs are scrutinised in the way the Single Source Regulations Office already does for single-source work, operators share in savings, and competition between at least two operators per step, with periodic re-tender, keeps the pressure on. The state owns the plant; it does not run it.

09 Where to build it: Ministry of Defence land first

Explosives plants need space, safety distances, rail, protection and neighbours who are used to them. The Ministry of Defence still owns land that has all five. The fastest route to a dispersed and defended estate is to build on it, under a planning route and a safety regime that already exist.

9.1 The land the Ministry still holds

SITE	WHAT IS THERE	STATUS
Eastriggs, Dumfries and Galloway	The First World War cordite town of HM Factory Gretna; later a depot of about 385 hectares inside the fence ¹⁸⁸	Ammunition removed by 2010; about 1,300 acres still owned by the Ministry and disposal reported paused pending a decision on future use ⁴⁵ ; the local MP says it is on the shortlist for a new factory ¹⁹⁵ ; parts are a scheduled monument
Longtown, Cumbria and the border	1,296 acres on former First World War propellant-factory land ⁴⁶	Active munitions depot
Kineton, Warwickshire	Described as the largest ammunition depot in western Europe ⁴⁶	Active
Beith, Ayrshire; Gosport	Depots of 180 acres (Beith, including a Special Area of Conservation) and 550 acres (Gosport) ⁴⁶	Active
Caerwent, Monmouthshire	Over 1,500 acres, the former Royal Naval Propellant Factory ¹⁹⁶	Training area; barracks planned
Otterburn and Ridsdale, Northumberland	Over 22,000 hectares at Otterburn, the UK's largest live-firing range ¹⁹⁷ ; Ridsdale, a munitions proof and test range ¹²⁴	Active; for proof, test and evaluation rather than production
Shoeburyness, south-east Essex	The Ministry's long-established weapons test and evaluation ranges on the Thames estuary, modernised under a long-term partnering contract ^{198, 199}	Active; for proof, test and evaluation, and a candidate for qualification of new lines
Woodbridge, Suffolk	Former air base, now Army barracks	Often thought sold; its planned closure was reversed in 2019 and it remains a Ministry site ²⁰⁰

The lesson of the last thirty years is that once explosives land is sold, it rarely comes back. Bishopton is becoming a town of 4,000 homes after extensive remediation¹²²; Bridgwater is a battery gigafactory²⁰¹; Chorley is a village²⁰²; Holton Heath is a nature reserve²⁰³. The Ministry's estate programme is releasing surplus land for more than 32,000 homes²⁰⁴, which is the right use for most of it. Land with an

explosives history, safety distances and rail access should be held back from disposal until the estate plan is set, as has happened at Eastriggs.

9.2 Land that was sold and never reused

Some former defence land has been sold and never brought back into productive use. Trecwn, the naval armaments depot near Fishguard, closed and was sold, and its chambers stand largely empty^{156, 189}; the regional authority markets it as an investment opportunity¹⁵⁷. It is better suited to the feedstock reserve (Section 4.6) than to modern explosives manufacture. Its Suffolk neighbour, Bentwaters, was sold after the Americans left and is now in mixed business use²⁰⁵. A survey of all sold explosives and depot land that has not been redeveloped should be part of the estate plan.

Where such land is needed, the Ministry has the powers to bring it back. The Defence Act 1842 allows land to be acquired for defence purposes⁴⁷ and the Acquisition of Land Act 1981 sets the procedure⁴⁸, with compensation at market value plus statutory loss payments^{206, 207}. The order of preference should be lease, then negotiated purchase, with compulsory purchase kept as a last resort.

9.3 Secure by design

The sabotage now running across Europe (Section 1.2) means every investor in this industry, public or private, will have to build securely: fences, detection, guarding, counter-drone cover, cyber protection and rebuild plans. On a greenfield site all of that has to be bought from scratch. On Ministry land much of it already exists: the perimeter, the safety distances that keep the public away, and the Ministry of Defence Police. The Ministry of Defence Police recovers its full costs from non-Ministry customers⁴⁴, so this extra layer of protection is not free, but its marginal cost on an existing defence site is far lower than recreating it elsewhere (estimated). The estate should be designated Critical National Infrastructure from the start (Section 10.5).

9.4 Planning: a national-importance route already exists

Ordinary permitted-development rights do not cover a new industrial plant on Crown land²⁰⁸. But since 2025 England has had Crown development routes under which applications of national importance, and urgent ones, are made direct to the Secretary of State, who decides them after consulting the local authority⁴⁹. Scotland has its own Crown application route²⁰⁹, and Wales its own. In England, an industrial project of national significance can also be directed into the nationally significant infrastructure regime²¹⁰. The recommendation is to designate the estate as of national importance and run every site through a single, coordinated consenting process in each nation, with planning, safety and environmental regulators working to one timetable.

9.5 Safety regulation: one regime, with civil scrutiny

Explosives and major-hazard law already makes room for defence. The Explosives Regulations 2014 disapply the civil licensing and separation-distance provisions at sites under the control of the Secretary of State for Defence, provided an approved scheme gives equivalent safety⁵⁰; the major-hazard regulations exclude establishments under the Secretary of State's control for defence

purposes⁵¹. The Ministry's guidance says a contractor may operate within its scheme where the contractor's staff work under the Ministry duty holder's supervision and the Ministry keeps effective control, and otherwise needs a civil licence²¹¹.

That is the government-owned, contractor-operated model in legal form. The recommendation is to use it by design: designated estate sites on Crown land operate under the defence explosives scheme, with the Health and Safety Executive scrutinising the scheme as it does today, so that each plant has one regulator, one licence and a national-security timetable, at a standard of safety no lower than the civil one. The Ministry's guidance chapter dates from 2019, and its munitions safety policy should be refreshed alongside²¹².

9.6 Safer plants, not looser rules

The best way to speed up consents is to build plants that are easier to consent. Britain is good at the two technologies that do that.

Continuous-flow manufacture. Making energetic material in small continuous streams rather than large batches means far less hazardous material is in process at any moment⁵³, which shrinks the consequences of an accident and the safety distances around it. UK firms are already developing it^{20,89}.

Multi-product sites. UK volumes of some materials are too small to keep a dedicated plant busy. Modular continuous-flow lines can be switched between related products in campaigns, as pharmaceutical plants already are, so one licensed site could make hexamine in one campaign and RDX or HMX in the next (estimated). The same holds for any product made by crystallisation, ammonium perchlorate included: continuous-flow crystallisers give close control of crystal size, down to very small crystals²¹³, and Britain has a national research hub in continuous manufacturing and crystallisation²¹⁴. Nitrocellulose is the exception, because it is made from a fibrous solid rather than crystallised, and needs a line of its own on the same site. The realistic model is a multi-product site that shares acids, utilities, safety distances, security and skilled staff across several modular lines. That is how small British volumes become economic, and it suits the operator model in Section 8.

Insensitive munitions, in the fill and the propellant. Plastic-bonded and other insensitive fills, and less sensitive propellants, react less violently to fire, impact or attack. The Ministry's own policy says the "operational, transportation and storage benefits are realised through improved hazard classification", with "reduced loss of people and assets following attack and accidents"⁵². A better hazard classification can mean smaller safety distances in storage, and so more stock per depot and more sites that qualify, though a NATO study finds the gain depends on the classification reached²¹⁵. Plastic-bonded fills are also widely expected to age better than older fills, though the public evidence this paper found does not settle it; NATO's munitions safety centre held a workshop on exactly this question in 2005²¹⁶. If UK surveillance testing confirms it, the gain is large: a Case A reserve of conventional rounds worth about £12bn that lasts thirty years rather than twenty needs about £0.2bn a year less in replacement (estimated).

Less TNT over time. Insensitive fills can replace TNT in most large-calibre natures: the US Army planned in 2013 to take its main 155mm high-explosive shell with an insensitive fill in place of TNT from March 2014, and to phase out TNT in other large-calibre rounds as stocks were used up²¹⁷. Not every nature or weapon has moved, and the new fills bring their own ingredient needs (Section 4.1). The

estate should therefore build insensitive-fill capacity first, keep a smaller TNT source and stock for the natures that still need it, and cut its toluene and TNT needs as the range moves across.

Built this way, the estate gives the Health and Safety Executive less to worry about, not more. That is the case to make to regulators: speed through safer design, not through exemption.

ADVERSARIAL VIEW: OLD MILITARY LAND IS NOT EMPTY LAND

The case. Former explosives sites carry contamination, heritage designations and conservation areas; Otterburn sits in a National Park; local opposition has already met proposals at Milford Haven²¹⁸ and in the Brecon Beacons²¹⁹. **Response.** All true, and none of it is a reason to choose greenfield sites, which face the same objections without the safety distances, the rail, the protection or the history. The national-importance route exists for exactly this kind of decision. Clean-up costs belong in the estate capital, and the heritage of places like Eastriggs is a reason to bring them back to life.

10 Energy, tax and protection

Energy is the cost that closed Billingham and the reason chemistry left the UK. A defence-critical regime, ring-fenced to designated sites and not extended to the wider economy, is the biggest single lever the government holds, and one of the cheapest.

10.1 The numbers

MEASURE	UK	COMPARATOR	SOURCE
Non-domestic electricity incl. taxes, medium consumer, H1 2025	£267/MWh	Highest of 15 European countries	⁵⁴
Industrial electricity, all International Energy Agency members with data, 2024	Highest	—	²²⁰
Eligible energy-intensive user, from 2026	£86/MWh	Germany £60; France £69	Government analysis cited by Nesta ⁵⁵
US industrial average, 2025	—	8.62¢/kWh (about £65/MWh)	⁵⁸ (derived)
Wholesale gas, 2025	about £27–34/MWh	Henry Hub about £9/MWh	^{57,58} (UK range estimated; 3–4 times US, derived)
Carbon on gas-fired power at today's prices	about £23–24/MWh	—	UK Emissions Trading Scheme about £48/t plus Carbon Price Support ^{221,222} (derived)
Gas cost per tonne of ammonia	£240–300	US about £80	¹⁵⁰ (derived); plus UK carbon £86–115/t

Two facts matter most for this paper. First, explosives manufacture is not among the codes eligible for the network-charge discount for energy-intensive industries, although fertilisers and nitrogen compounds are⁵⁶; whether it qualifies for the new competitiveness scheme from 2027, which removes several policy levies but not the Contracts for Difference levy, is not confirmed^{117,223}. Second, other governments are already acting: Germany has set an industrial power price of 5 cents a kilowatt-hour on half of eligible firms' consumption, cut its electricity tax and subsidised grid fees by EUR6.5bn^{224,225}, and France's regulator puts the full cost of existing nuclear at about EUR60/MWh²²⁶.

10.2 A defence-critical energy regime

The regime applies only to designated defence-critical sites: the estate and the feedstock plants that supply it. It is not an economy-wide change. Its assumptions are deliberately hard-edged:

MEASURE	EFFECT
Outside carbon pricing	Exempt from the UK Emissions Trading Scheme, Carbon Price Support and the Climate Change Levy, for energetics and for the ammonia and nitric acid that feed them
Outside policy levies	Full relief from Renewables Obligation, Feed-in Tariff, Capacity Market and Contracts for Difference costs, and the maximum network-charge discount, whatever the activity code
Right to generate	Sites may build their own gas-fired power and heat. Outside carbon pricing that power costs about £63–76/MWh at 2025 gas prices (derived from government cost data ²²⁷), close to German and French industrial levels
Heat recovery and site integration	Nitric and sulphuric acid plants are candidates for exporting energy ²²⁸ . Co-locating them with the ammonia plant, acid recovery and the energetics lines lets surplus heat and steam be reused on site and cuts purchased energy (estimated); a research line in Section 13 should push it further. Heat recovery must never compromise process safety, so most of the gain comes from the acid and utility plants rather than the energetic steps
Feedstock gas at cost	Gas used as a raw material, for ammonia above all, supplied at wholesale cost without policy levies, with a state price backstop for the ammonia plant if needed
Border protection kept	The carbon border charge on imported ammonia and nitric acid from 2027 ¹⁵¹ continues to apply, so imports cannot undercut the British plant

The target is simple: energy for defence-critical chemistry at or below what German and French competitors pay.

10.3 Tax

Every designated site gets the reliefs now available in Freeports and Investment Zones, including enhanced capital allowances, employer National Insurance relief and business rates relief, without the 2031 and 2034 end dates²²⁹, alongside full expensing and research relief. Teesside, Grangemouth and Milford Haven already sit in Freeport areas.

10.4 What it costs the Exchequer, and what comes back

MEASURE	REVENUE FORGONE A YEAR (ESTIMATED)	BASIS
Carbon pricing exemption on designated sites	£50–80m	About 1–1.5 million tonnes of carbon dioxide from the ammonia plant and on-site power at about £48 a tonne, plus Carbon Price Support, less free allowances
Policy-levy and network-charge relief on site electricity	£60–90m	About 2 terawatt-hours a year at £30–45/MWh of levies; borne by the Exchequer or other bill payers

MEASURE	REVENUE FORGONE A YEAR (ESTIMATED)	BASIS
Feedstock gas backstop for ammonia	£0–70m	Only if needed; up to the gap to the US gas price on 300,000 tonnes
Freeport-style reliefs	£60–100m	Employer National Insurance, business rates and enhanced allowances on designated sites
State reinsurance	About nil	Premium-funded on the Pool Re model; a contingent liability, not a running cost
Total	£0.2–0.35bn	This paper budgets £0.35bn a year

Against the Exchequer as a whole it is small. £0.35bn is about 0.04% of HMRC's £966bn tax receipts in 2025/26³⁷, about 0.4% of the £95bn raised by corporation tax⁵⁹, and about 1.3% of the £26bn of business rates collected in England²³⁰. **Against what it makes possible it is smaller still.** Without the regime the chemistry does not come to Britain. Set against the tax paid by the estate's own workforce and the 277,000 tonnes of ammonia imports a British plant would replace¹³⁴, it still returns several times its cost. Set against the whole programme it enables, which brings back about £2.0–3.1bn a year in tax once built (Section 7), it returns six to nine times its cost.

10.5 State protection

MEASURE	PURPOSE
Critical National Infrastructure status	Physical, personnel and cyber protection to national standards; plans to rebuild after attack
Special share and ownership screening	No sale, merger or change of control without consent (Section 8)
State reinsurer	Commercial cover for explosion and hostile-act risk is thin. Pool Re, with a fund of about £7.4bn and an unlimited Treasury facility for terrorism, is the model ²³¹
State lending	Firms in the sector report being refused banking ²³² ; the National Wealth Fund and British Business Bank should lend directly

The legal basis. The Subsidy Control Act places national-security measures outside its regime²³³, and the UK's trade agreement with the EU has a security exception. Because a carbon-pricing exemption touches trade commitments, the regime should rely on the security exception explicitly and stay ring-fenced to defence-critical sites.

11 Every nature, air-launched munitions, missiles and drones

Sovereignty in 155mm alone is not sovereignty. The Army fires tank and mortar rounds and Guided Multiple Launch Rocket System (GMLRS) rockets, the Navy's new frigates fire 5-inch and 57mm, the Royal Air Force projects force with bombs and missiles, and missiles of every kind depend on the same energetic supply chain.

11.1 Every land and naval nature, not only 155mm

NATURE	USED BY	UK POSITION
155mm	RCH 155, Archer	Filled in the UK at Glascoed, capacity expanding ²⁰ ; about 50,000 rounds a year
120mm	Challenger 3 (148 tanks)	Gun and ammunition from Germany ²⁵ ; the 2020 arrangement covered Challenger 2's rifled rounds, not its successor's ⁶⁰
5-inch naval	Type 26 frigate's new gun	UK qualification; no public evidence of UK production ⁶¹
GMLRS guided rockets	M270 launchers	Bought from the US. Lockheed Martin and Rheinmetall will also make GMLRS at Unterlüß in Germany ²³⁴ , and Australia is building a GMLRS complex ²³⁵ . No UK production
105mm, mortars, medium calibre	Light gun, infantry, armoured vehicles	Largely within the partnering arrangement, which covers 39 types from small arms to artillery and tank rounds ¹²⁴

The long-term partnering arrangement runs for fifteen years and should be honoured. The second, independent large-calibre house this paper recommends is anchored on the natures outside it, 120mm smoothbore and 5-inch, and draws on the same estate for its explosives and propellant. Over time it gives every major nature two British sources.

11.2 Air-launched munitions

An island nation keeps threats at a distance by projecting force, and much of that force is delivered from the air. Use in recent campaigns gives a sense of scale. British aircraft and helicopters used more than 1,400 precision-guided munitions over Libya in 2011, including more than 60 Storm Shadow missiles⁶². Over Iraq and Syria, by August 2016, the RAF had released about 1,340 Paveway bombs, 210 Brimstone and 470 Hellfire missiles, at unit costs the government put at about £23,000, £105,000 and £70,000²³⁶, and Paveway IV led the replenishment that followed²³⁷. A peer war would use these numbers in weeks, not years.

Britain makes much of this itself. Paveway IV has been built at Glenrothes and Harlow²³⁸, and MBDA opened a £50m manufacturing facility at Bolton in 2018²³⁹. The gaps are the same as everywhere else in this paper: the energetic fill, the rocket motors and the feedstocks beneath them. This paper adds an

air-launched stock line of £3bn in Case A and £6bn in Case B (estimated), and puts the fill and motor supply for these weapons inside the estate.

11.3 Missile production: two new independent sources

The Strategic Defence Review wants up to 7,000 UK-built long-range weapons¹⁷, and Ministry officials briefing on the Defence Investment Plan said too much munitions money had been going on high-end, complex munitions²⁴⁰. Whatever the mix the government settles on, Cases A and B size missile and interceptor stocks well above today's (Section 5.4), and every one of them needs rocket motors, warhead fill, initiators and fuzes. Britain's rocket-motor capacity is now held within a single missile group²⁴¹.

This paper's recommendation is limited to the supply chain. Two new British sources are needed, each independent of the main missile house: one making nitrocellulose-based solid rocket grains, and one making HMX and plastic-bonded warhead fills. Both draw their nitrocellulose and HMX from the estate. Both would serve the new British firms building low-cost interceptors and strike missiles (Section 13) as well as the established primes, so that no single site or owner is a point of failure. Missile design and performance are outside the scope of this paper.

11.4 The materials beneath the missiles

VitalSpec's companion review of the missile supply chain finds that Britain can make missile motors and warheads, but very little of what goes into them⁶³.

MATERIAL	POSITION	PATH
Ammonium perchlorate, the oxidiser in composite motors	Western supply rests on three merchant producers, each on a single site, in the United States, France and Japan ^{63, 242, 243, 244} , plus a captive US line still scaling up ²⁴⁵ . The US missile ramp is absorbing the headroom (estimated)	Allied supply agreements and two years' stock now; a UK line alongside UK composite-propellant casting, with allied buyers
Binders and specialist additives	Few producers and a record of single-source failures; a second source for the common binder takes 18-24 months to qualify ¹⁴⁰ ; one analysis counts more than 100 single points of failure below the US motor makers ²⁴⁶	Qualify a second source on every UK motor programme; rotated stock
Metal powders	Two UK sources of aluminium powder identified, one confirmed as a maker, neither known to be qualified ^{142, 143} ; magnesium and titanium about 70-90% Chinese ^{144, 145}	Qualify a UK maker; store the rest
Fibres for nozzles and cases	The US buys aerospace-grade rayon fibre for all its services from a single source ¹⁴⁶ ; China passed half of world carbon-fibre capacity in 2025 ²⁴⁷	Allied agreements and shared stock
Magnets, gallium, germanium, antimony	China's pauses on its October 2025 rare-earth controls and on its gallium, germanium and antimony ban for the US end on 10 and 27 November 2026 unless extended; its April 2025 rare-earth licensing stays in force, and defence end users are excluded throughout ^{148, 248, 249}	Store; diversify; plan for US rules from January 2027 ¹⁴⁹

The binding constraint is time, not tonnage: changing one ingredient means requalifying the propellant and potentially the motor and the missile¹⁴⁹. So the materials need the same treatment as the estate's other feedstocks: buy from allies, store what is slow to replace, and qualify a second source on every UK motor programme. These measures cost about £0.1-0.35bn over ten years (estimated), about one per cent or less of the missile and interceptor stock they protect; this paper carries them within the missile-energetics line in Section 6.

11.5 Drones: a nature in their own right

Drones now do much of the killing in Ukraine: a RUSI analyst, quoted by Reuters Breakingviews, put them at about two-thirds of Russian equipment destroyed in 2024²⁵⁰. Ukraine delivered about 3 million first-person-view attack drones to its forces in 2025⁶⁴, plans more than 7 million drones in 2026²⁵¹, and signed about \$8bn (UAH 333bn; derived) of drone contracts in the first half of 2026 alone²⁵². Russia is matching it: Ukrainian intelligence reports a Russian plan for 7.3 million attack drones and 7.8 million drone warheads in 2026⁶⁵, and it launched more than 54,000 long-range one-way drones and decoys at Ukraine in 2025²⁵³. The UK's own figure is that Ukraine uses about 200,000 drones a month²⁵⁴.

The Strategic Defence Review set a "20-40-40" force mix of crewed platforms, reusable uncrewed systems and expendables²⁵⁵; the Defence Investment Plan provides more than £5bn for drones and autonomy over four years²⁵⁴; UK drone deliveries to Ukraine have grown from more than 10,000 in 2024 to at least 120,000 planned for 2026^{256,257}; and UK production of the Octopus interceptor drone was due to begin in January 2026²⁵⁸. But the UK has published no volumes for its own forces, and several of its new drone factories are foreign-owned^{259,260,261,262,263}.

UK DRONE NEED (ESTIMATED)	A: BETTER-SIZED MILITARY	B: WAR FOOTING	BASIS
Attack drones used a year in war	—	200,000-250,000	About 2,500 a month per brigade, the need Ukrainian brigades report ²⁶⁴ , for seven or eight brigade-equivalents (estimated)
Attack drones held in reserve	50,000-100,000	100,000-200,000	Three to six months of war use for A; more for B (estimated)

Two things follow. First, drone munitions are a new demand on the estate but a modest one: at a kilogram to a few kilograms each, a few hundred tonnes a year in war against 12,000 tonnes of explosive capacity in Case B (estimated). Ukraine's problem is not explosive tonnage but supply arrangements: a member of its parliament's defence committee said in April 2025 that drone munitions lagged drone deliveries and some were home-made²⁶⁵, and its defence minister says there is "a global shortage of explosives"²⁶⁶. Second, the hard constraints are components. Ukraine has cut the share of drone parts it imports directly from China from about 90% to 28%, but magnets, motors, battery cells and thermal sensors remain choke points²⁶⁷: the same critical minerals as in Section 11.4.

The recommendation is to treat drone munitions as a nature in their own right: standard UK drone warheads, qualified once and filled on the estate's lines, held in reserve and included in mutual-production agreements with friends. Airframes sit in the Defence Investment Plan's drones line: at the US programme's target price of \$2,300-5,000 a drone²⁶⁸, the reserve above would cost it about £0.1-0.75bn (derived). This paper sizes only the munitions, whose fill sits within the estate's capacity.

12 Exports: friends first

A war-sized estate has spare capacity in peace. Selling it keeps lines and people warm, earns money and binds allies to us. Our friends need it now: their own suppliers are years behind.

12.1 Why our friends need British supply

Allied order books are longer than allied factories can fill. Rheinmetall's stood at EUR80.5bn in June 2026⁶⁹; MBDA is doubling Aster output this year to work down its orders²⁶⁹; Nammo's order book is almost four years' revenue¹⁹¹; and Switzerland has been told its Patriot systems will arrive five to seven years late⁶⁷. For a country planning its defence in this environment, a place in a queue that long is not reassurance. Britain can shorten the queue for its friends.

Government policy already points this way. The Strategic Defence Review says: "If we fight together, we should build together"⁷⁰. The Defence Industrial Strategy says that "the UK will export its world-leading defence capabilities to allies around the world"²⁷⁰. A British estate with spare capacity is how those words become rounds delivered.

12.2 Our oldest and truest friends

These are named, not ranked. Each has a claim on British supply through history, treaty or shared sacrifice.

FRIEND	WHY
Portugal	Our oldest ally, under the Treaty of 1373 ⁷¹ ; reaffirmed in a 2022 joint declaration ²⁷¹ ; reached 2% of GDP on defence for the first time in 2025 ²⁷²
Australia	AUKUS and Commonwealth partner; natural source of cotton linters (Section 4.3)
Canada and New Zealand	Commonwealth and Five Eyes partners
Norway	Lunna House agreement, 2025 ⁷⁴ ; buying Type 26 frigates ¹⁸
Poland	Northolt Treaty, 2026 ⁷³ ; UK Export Finance is backing about £9bn of financing for its air defence ²⁷³
Germany and France	Trinity House Agreement, 2024 ⁷² ; Lancaster House treaties, 2010 ⁷⁵
Denmark and Estonia	Fought alongside British forces in Helmand ⁷⁶ ; with the other Nordic and Baltic members of the Joint Expeditionary Force, the front line of any war with Russia
Ukraine	For as long as it needs help
United States	Our closest ally and AUKUS partner. Its own industrial base is large enough to mend itself, so British supply matters most to the others on this list

12.3 First call on supply

When output is short, the order of call is: the UK's own reserve and operations; then these friends, under standing agreements for mutual production and priority supply; then the wider market. In return, friends with capacity of their own agree to make for the UK if British plants are hit.

12.4 Open licences, unchanged criteria

An open general export licence should cover treaty partners for the outputs of the estate, on the precedent of the AUKUS open general licence introduced in 2024⁷⁷. Everyone else outside the embargo list²⁷⁴ applies for individual licences on a fast track, under today's licensing criteria, unchanged. This paper does not propose loosening them.

12.5 The market

UK defence export orders were £13.2bn in 2024, and Europe took 38.4% of orders over 2020–24; the five-year European average rose from £0.7bn in 2017 to £3.6bn in 2024²⁷⁵. The UK is the world's eighth-largest exporter of major arms, with 3.4% of the market²⁷⁶. The strongest demand is for the chemistry: Europe's largest ammunition maker says powder output may need to nearly double¹⁰², and Poland's state TNT maker is exporting to the United States¹⁰⁷. UK Export Finance has £130bn of capacity including the new defence fund to back buyers¹⁹. This paper's recommended case assumes about £2.25bn a year of exports once the estate is built (Section 7), a sixth of today's export orders.

13 New entrants, skills and research

The estate needs many operators, and the firms best placed to be agile and innovative are often not the largest. They face an uphill struggle, and the research that would make them world-leading is not yet funded at scale.

13.1 Small and mid-sized firms

The Ministry spent £1.24bn directly with small and medium-sized enterprises in 2024/25, 3.9% of the total (derived), and its own action plan acknowledges the complexity of its processes⁷⁸. The Scottish Affairs Committee heard that defence processes were designed for primes, of firms brought close to bankruptcy, and of firms refused banking⁷⁹. Among firms outside the partnering arrangement that are building or seeking energetics, munitions, missile and drone capability in the UK:

FIRM	WHERE; OWNERSHIP	WHAT IT IS DOING	MINISTRY SUPPORT AND STATUS
Energetics, explosives and pyrotechnics			
The Coventry Arsenal	Coventry and Kington (planned); UK	Shell bodies, fuzes, propellant, charges and explosives; reports a new British 155mm fuze	Incorporated 2025 ⁸¹ ; proposal
NiTech Solutions	Edinburgh; UK	Continuous-flow chemical manufacturing ⁸⁰	Defence innovation demonstration; operating
PW Defence	Draycott, Derbyshire; UK	Military pyrotechnics ²⁷⁷	£15.6m single-supplier extension to 2028 ²⁷⁸
TBG International	UK	Proposed energetics plant at the former Mossmorran chemical site, Fife ²⁷⁹	Environmental impact assessment stage, 2026
Glan Usk Estate	Near Tredegar; UK landowner	Proposed explosives factory inside a national park ²¹⁹	Early proposal; opposed locally
Munitions and rounds			
Tiberius Aerospace	US-developed	New 155mm round; \$500m deal with unnamed UK technology partners to manufacture and license it ²⁸⁰	Ministry trials contract, 2025 ²⁸¹
Rocket motors, interceptors and strike weapons			
Cambridge Aerospace	Cambridge; UK, venture-backed	Skyhammer interceptor; own Nightstar rocket motor in development ^{68, 282}	Production contract, April 2026 ²⁸³ ; low-cost air defence contract ²⁸⁴ , now over 250 staff ⁶⁸

FIRM	WHERE; OWNERSHIP	WHAT IT IS DOING	MINISTRY SUPPORT AND STATUS
Frankenburg Technologies	London headquarters; Estonian	Low-cost air-defence missile; five-year rocket-motor partnership with Roxel UK ^{285, 286}	Low-cost air defence contract ²⁸⁴ ; UK production planned 2027
Greenjets	London and Milton Keynes; UK, venture-backed	Counter-drone interceptor and propulsion ²⁸⁷	Low-cost air defence contract ²⁸⁴
MGI Engineering	Witney, Oxfordshire; UK	Low-cost long-range strike weapon	Project Brakestop (a sovereign long-range one-way effector), about £5m then £15m ²⁸⁸
Rotron Aerospace	UK site; US-owned since 2026 ²⁸⁹	One-way long-range effector and engines	Brakestop, about £5m then £15m ²⁸⁸
Cody Aerospace and Defence	UK start-up, founded 2026	Containerised strike missile; planned UK factory ⁸²	Design stage; no contract
Drones and loitering munitions			
Modini	Pewsey, Wiltshire; UK	One-way strike drones	£4.5m Ministry contract under Project ASGARD ²⁹⁰
STARK; Helsing; Neros; Ukrspecsystems; Tekever	Swindon, Plymouth, Mildenhall; German, US, Ukrainian and Portuguese-owned	Loitering munitions and drones built in UK factories (Helsing's Plymouth factory makes underwater gliders) ^{259, 260, 261, 262, 263}	Operating or opening; Tekever is no longer small
Counter-drone and test			
MARSS; OpenWorks	UK; MARSS Australian-owned since 2026	Counter-drone systems ^{291, 292}	Operating
Radnor Range	Powys; UK	Private munitions test and evaluation range ²⁹³	Ministry-approved range
Publisher			
VitalSpec	UK	Publisher of this paper	See the declared interest on page 2

Who this paper is for. The operator model is designed for firms like these: British-owned small and mid-sized firms first, and foreign-owned firms that build, employ and pay tax in Britain. The Ministry has not named the 22 firms funded for energetics-factory feasibility studies, which a Ministry official says range "from innovative SMEs to major defence primes and major chemical industry partners"²⁹⁴, and no small UK maker of rocket motors, fuzes or shell bodies yet operates at scale on public evidence.

Project Safari, the new single point of contact for small firms seeking test sites, is the kind of help that works²⁹⁵.

The estate model lowers their barriers directly: the state carries the plant, so the entrant needs working capital, people and know-how rather than hundreds of millions; the defence safety regime and national-importance planning route remove years of consenting; long operating contracts make them bankable; and rotation of the feedstock reserve gives them steady revenue from the start. For the missile entrants, the Ministry should move from development grants to production contracts with volume, which is what lets a factory be financed.

13.2 Skills and regulators

Three decades of decline have thinned the pool of energetic chemists, chemical engineers, explosives technicians and inspectors. The estate's direct plant workforce is estimated at 4,000 to 8,000, against about 1,260 direct jobs under the current partnering arrangement¹²⁴ and 19,000 in the Royal Ordnance Factories at privatisation¹²⁰. The skills line in Section 6 funds apprenticeships, degree places and conversion courses at the clusters, and a matching increase in the explosives inspectorate and defence safety regulator, which will otherwise become the bottleneck.

13.3 Research: safer, more modern and less import-dependent

The UK is a strong innovator in chemistry and engineering. Six lines of research would make the estate safer, cheaper and more sovereign, and each is a field where Britain could lead:

RESEARCH LINE	WHY IT MATTERS
Plastic-bonded and insensitive fills across every nature	Less sensitive munitions are safer to make, store and carry, earn better hazard classification ⁵² , and move the whole range in the modern direction allies are taking, and reduce the need for TNT and toluene over time (Section 9.6)
RDX-based (nitramine) propellants that need less nitrocellulose	Reduces dependence on cotton linters, the one input the UK cannot grow, and builds on the RDX capacity the estate creates
Continuous-flow manufacture	Smaller hazardous inventories, smaller plants and faster consents ⁵³ ; UK firms already lead here ⁸⁰
Multi-product modular lines	Lets one licensed site make several small-volume materials in campaigns, sharing acids, utilities and staff (Section 9.6)
Heat recovery and site energy integration	Reuses surplus heat from acid and utility plants on co-located sites, cutting purchased energy without compromising process safety (Section 10.2)
Digital qualification	Fewer rounds down the range to qualify a line or accept a lot (Section 13.4)

13.4 Digital qualification: fewer rounds down the range

Qualifying a new line, and accepting each lot it makes, has traditionally meant firing large numbers of rounds. The United States is changing that. Its Army test command has set goals to cut full-up live-fire

testing by a third by 2030 and by two-thirds by 2035⁸³. Its ammunition programme office is building digital twins of its plants²⁹⁶, its munitions command is applying artificial intelligence to X-ray and computed tomography inspection²⁹⁷, and research for its acquisition community argues for accepting in-line sensor data as quality evidence²⁹⁸. A West Point study found confidence-based skip-lot sampling cut lot tests by 23 to 77% in simulation²⁹⁹. NATO's munitions safety centre has surveyed allies on digital test and evaluation³⁰⁰.

The UK has the expertise, including Cranfield's centre of excellence in test and evaluation³⁰¹ and the ranges at Shoeburyness¹⁹⁸, but no public programme equivalent to the US one. The recommendation is a UK digital qualification programme, led by the defence safety and acceptance authorities with industry, to agree the evidence (process data, modelling, non-destructive inspection, statistical sampling) that can replace part of live firing. Its biggest beneficiaries are new entrants, for whom the cost and time of qualification is among the largest barriers to entry.

PART III • DOING IT

14 How government should do it: test, learn, scale

A programme this size can fail by trying to design everything first. Government should do the opposite: start with the powers it already has, put the first plants on the ground and the first stock in store, measure what works, and scale only that.

GATE	WHAT HAPPENS	TEST BEFORE MOVING ON
Gate 0: decide	Set reserve targets (published as ranges); hold explosives-history land back from disposal and survey sold land that was never reused; create the estate company; designate defence-critical sites and switch on the energy, tax and protection regime; open the national-importance planning route for the first sites; buy the first tranche of the feedstock reserve this financial year; license the L15 body and place the first orders for empty bodies; agree the first mutual-production arrangements with friends. All of this can be done under existing powers or short secondary legislation.	Sites designated; regime in force; first operating competitions launched; first reserve stock in store
Gate 1: first plant per step	One plant for each critical step on Ministry or existing chemical-cluster land, built secure and safer by design, run by competitively chosen operators on ten- to fifteen-year contracts; the ammonia plant started; production contracts for low-cost interceptors; digital qualification pilot with the safety authorities.	Time to consent, build and qualify; cost against benchmark; safety record; operator payback on track
Gate 2: second sources	A second, separate source for every critical step; the second large-calibre house anchored on 120mm and 5-inch; the two new missile-energetics sources; export framework with friends in force; full feedstock reserve.	No single point of failure; first exports; lot-acceptance costs falling
Gate 3: war capacity	Surge capacity to Case B; hardened and dispersed sites; spare plant in reserve; reserve fill on track.	Ability to double output within months, demonstrated in exercise

Each gate expands only what the previous one proved. Results are published, so Parliament and industry can see what is working. Operators that fail are replaced; models that fail are changed. This is how the best industrial programmes abroad have moved fast: the German procurement law and the Polish special act were both designed to get money and contracts moving first and refine later^{13,105}.

15 What would make us wrong

IF THIS HAPPENS	WHAT IT WOULD MEAN	WHAT TO WATCH
The threat recedes	Demand for a war-sized estate weakens. The answer is built in: capacity fees can be stepped down, spare plant mothballed rather than sold, and the estate kept public so it can be restarted	NATO threat assessments; Russian production; arms-control progress
Prices fall back to pre-war levels	Private paybacks lengthen to ten or twenty years, a sovereignty premium appears, and export income halves. This is the risk the state-owned estate exists to carry	European round, charge and powder prices
European supply catches up	Shells become cheap and plentiful; the case rests on redundancy and chemistry rather than shortage ¹⁰¹	Delivery against announced capacity; allied order books
A new manufacturing route succeeds at scale	Continuous-flow or modular production lowers capital cost. Good news: the estate should host several routes, not depend on one owner's	Industrial-scale output from the UK pilots announced for 2026 ²⁰
Low-cost interceptors disappoint	More high-end interceptors are needed, and the missile line costs much more	Trials and first production lots of the new British designs
Capped margins breed cost	Operators spend more to earn more; the estate costs more than benchmark	Unit costs against European comparators; savings shared
Skills or regulators cannot scale	Plants are built but not licensed or staffed on time	Inspector numbers; apprenticeship intake; time to licence
The energy regime is challenged	Trade partners object to a carbon-pricing exemption	Formal challenges; reliance on the security exception
Local opposition stops sites	Dispersal slows	Outcome of the first national-importance applications ^{218, 219}

ADVERSARIAL VIEW: THIS IS A RETURN TO STATE INDUSTRY

The case. Public ownership of an industrial estate, capped profits and state protection sound like the nationalised industries of the 1970s. **Why the paper does not hold it.** The model recommended here is how the United States Army and the Australian government already own their ammunition plants, how Norway, France and Poland hold their energetics, and how the UK itself finances Sizewell C and the Thames Tideway Tunnel. The state owns the plant because the market will not carry the price risk or pay for idle surge; private firms run it because they do it better. Defence is the first duty of the state, and the supply of its munitions is part of that duty.

16 The estate in 2075

This paper quantifies the first decade. The case is for fifty years.

Chemical plants, safety distances, consents and skilled communities take a decade to build and a generation to mature. Once lost, they take as long to rebuild, as the last thirty years have shown. A sovereign estate is therefore a fifty-year asset, like a power station, a reservoir or a dockyard. In 2075 it should look like this: a network of publicly owned, well-protected sites across the four nations, run by a changing cast of British operators who compete on cost, safety and innovation; a reserve of munitions and feedstocks refreshed by rotation rather than rebuilt in a panic; a chemical industry that serves farming, mining and medicine as well as defence; a workforce that passes its skills on; and a set of friends who know that Britain will supply them, and who will supply Britain in turn. The cost of that is a fraction of a percent of national income a year, and most of it stays on the nation's books.

A Annex A: Capability map

Energetic materials and manufacturing steps, from public sources at October 2026. Feedstocks are mapped in Section 4.1. "Path" is this paper's recommendation.

LINK	SERVES	UK STATUS	PATH TO BRITISH
Nitrocellulose	Propellant; rocket grains	No military producer at scale identified ²⁴	Two estate sources
Gun propellant and charges	Every gun nature	New Scottish facility from early 2027 ²¹ ; further capacity planned ²⁰	Two estate sources plus private lines
TNT	Melt-cast fill	None since 2008 ²³	Estate source; Polish and US examples ^{107, 110}
RDX and HMX	Fill, boosters, plastic-bonded explosive	Not at scale since 2008 ¹²¹ ; industrial capacity planned from a continuous-flow pilot ²⁰	Two estate sources, more than one route
Plastic-bonded and insensitive fills	Modern fills for every nature	Limited (estimated)	Estate source; research line (Section 13.3)
Filling and assembly	Finished rounds	155mm at Glascoed ²⁰ , about 50,000 a year; 120mm imported ²⁵	New lines from year four; second independent house
Shell bodies	Every projectile	UK bodies about £500 each	Licensed L15 bodies stored as a bridge; second UK source
Rocket grains and warhead fill	Missiles	UK capacity within one missile group ²⁴¹	Two new independent sources: nitrocellulose-based grains; HMX and plastic-bonded fills
Fuzes, primers and initiators	Every nature	Partial; The Coventry Arsenal ⁸¹ reports a new British 155mm fuze	Second British source within the estate plan
Test, proof and qualification	New lines; lot acceptance	Ranges at Otterburn, Ridsdale and Shoeburyness ^{124, 197, 198}	Digital qualification programme
Munitions storage	Reserve	Depots at Kineton and Longtown ⁴⁶	Licensed storage for the reserve; insensitive fills to raise capacity
Feedstock storage	Feedstock reserve	Trecwn and other former depots unused ¹⁵⁶	Ministry-owned reserve, privately managed and rotated ³⁰

B Annex B: Sizing, cost and returns workings

All figures estimated unless marked. The model is reproducible from the assumptions in Annex D.

ELEMENT	CASE A	CASE B	BASIS
Shell-loading capital	£0.65bn	£1.30bn	EUR2,500 per annual round (comparator range EUR1,430–3,800)
Propellant-chain capital	£1.46bn	£2.51bn	Nitrocellulose at EUR400m per 4,000 annual tonnes plus powder and charges at EUR350m per 2,500 annual tonnes ¹³³ ; about £209,000 per annual tonne
High-explosive capital	£0.53bn	£0.90bn	£300m per 4,000 annual tonnes of RDX: £75,000 per annual tonne, applied to all explosives. A single US TNT plant is costed at \$435m ¹¹⁰ , so this line is at the low end and carries the ±50% in Annex D
Feedstocks	£0.6bn	£0.8bn	Estate share of the ammonia plant (which is financed mainly on its civil market), acid concentration and pulping
Missile energetics	£1.5bn	£2.5bn	Two new independent sources; judgement. Also carries the missile-materials programme of about £0.1–0.35bn (Section 11.4)
Other natures and fuzes	£1.5bn	£2.5bn	Judgement
Dispersal and redundancy	£1.87bn	£6.31bn	30% and 60% of production capital
Test, evaluation and licensed storage	£3.0bn	£5.0bn	Judgement
Rounds made (thousand, years 1–10)	50, 60, 80, 120, 180, 240, then 300	50, 70, 120, 200, 320, 450, then 600	Training use 50,000 (A) and 75,000 (B) a year
Net into reserve in ten years	1.43m	2.86m	At £5,000 a round: £7.2bn and £14.3bn
Licensed empty bodies	0.5m	1.0m	At an average £475 (UK £500; India \$600)
Missiles and interceptors	£31.2bn	£55.5bn	Long-range 7,000 / 10,000 at £1.75m; high-end interceptors 4,000 / 8,000 at £2.5m; low-cost 30,000 / 80,000 at £0.1m; short-range and counter-drone £6bn / £10bn
Standing-capacity fee	8% a year	10% a year	Of production capital, for seven years once built; halved in Case R

RETURNS MODEL: HOW FIGURE 1 IS BUILT

Spending profile (Case R). Estate capital of £21.8bn spent over years 1–7 (5, 12, 18, 22, 20, 15 and 8%); reserve rounds bought as made, at the Case A pace; other stock spread over years 2–10; licensed bodies in years 1–3; standing fees from year 5; regime cost from year 2; skills evenly. After year 10, about £2.8bn a year: £1.25bn replenishment, £0.6bn fees, £0.35bn regime and £0.6bn skills.

Cash back. 80% of spend (excluding the regime) is assumed to be UK content. It creates GDP at a multiplier of 1 (cautious) or 1.5 (European evidence for low-import countries¹⁸³), taxed at a 37% average tax take (the Office for Budget Responsibility forecasts 36–38%¹⁸⁵). Exports are the spare capacity (Case B less Case A) at £5,000 a round, multiplied by 1.5 for energetics and other natures sold alongside; they are taxed the same way, and 15% of export revenue is returned to the estate as rent.

Assets. Stock is held at cost and not run down, because training rounds are funded from the existing line; stock bought after year 10 continues the reserve towards two million rounds and is counted too; the estate is depreciated straight-line over thirty years. Fees, the regime and skills are not counted as assets.

Bottom-up check (year 8). 48,000 direct and supply-chain jobs at about £15,100 of income tax and National Insurance each; 65,000 jobs supported by workers' spending at about £8,600 each; VAT at 12% of 70% of spending; corporation tax at 25% on a 10% margin; plus export taxes and rent. Total £2.0bn before the induced jobs, which use an older ratio and are an upper bound, and £2.7bn with them, against £3.1bn top-down.

BENCHMARK CALCULATION: ENERGY

Ammonia uses about 32 GJ of gas per tonne, or 8.9 MWh¹⁵⁹. At £27–34/MWh that is £240–300 a tonne; at Henry Hub's 2025 average of \$3.53 per million British thermal units⁵⁸, about £80. Carbon at £48 a tonne on 1.8 tonnes of carbon dioxide for a modern gas plant (2.4 on the global average) adds £86–115 (derived). For own generation, government cost data put the non-fuel, non-carbon cost of a gas plant at about £11/MWh in 2021 prices²²⁷; uplifted to about £14 and with fuel at 55% efficiency, power costs about £63–76/MWh outside carbon pricing (derived). The carbon cost of gas power today is about £23–24/MWh: the UK Emissions Trading Scheme at about £48 a tonne on 0.35–0.37 tonnes per MWh, plus Carbon Price Support of 0.331p per kWh of gas^{221,222} (derived).

c Annex C: Sources

Sources are listed in order of first citation. Primary sources (government, parliament, legislation, regulators, company filings) are used wherever one was found; trade and general press, and encyclopaedia entries, are used where no primary source was found and are identified by name. Where a source title names a company this paper does not name, the entry is described neutrally. VitalSpec internal research papers are listed for completeness. Any figure or factual claim in the text with no citation and no other label is VitalSpec market information, drawn from VSR Trading's own market activity and industry contacts. Access date for all web sources: October 2026.

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D Annex D: Assumption register

#	ASSUMPTION	VALUE	BASIS AND SENSITIVITY
1	Exchange rates	EUR1 = £0.87; \$1.33 = £1	Approximate; low sensitivity
2	UK GDP	£3.0tn, held flat	Conservative: growth lowers every share-of-GDP figure
3	UK share of European NATO economy	13–15%	Sets the reserve share; war-case capacity is rounded up from it to about a sixth of Russia's 2025 howitzer output
4	Today's UK 155mm output	~50,000 a year	VitalSpec market information; the 2020 contracted rate was about 100,000 large-calibre rounds across all natures ⁶⁰
5	Energetic material per round-equivalent	~10 kg each of propellant and explosive	Strategic conversion only
6	Capital benchmarks	See Annex B	Nitrocellulose and RDX plant costs are VitalSpec market information; ±50% possible
7	Dispersal premium	30% (A) / 60% (B)	Judgement; large sensitivity
8	Round value, UK-built	£5,000	Build-up from VitalSpec market information: body £500, filled and fused projectile EUR2,000, full charge \$4,500; complete round EUR6,200 in the market
9	Pre-war price level	About a third of today's	EUR2,000 shell before 2022 ²⁸ against EUR6,200 today; drives the payback and premium tests
10	RDX selling price	\$50–100 a kilogram	Estimated; payback range robust across it
11	Licensed L15 bodies	0.5m / 1.0m at £475	VitalSpec market information; design rights to be confirmed
12	Long-range weapons	7,000 / 10,000 at £1.75m	Strategic Defence Review figure ¹⁷ ; unit costs from public budget data
13	Interceptors	High-end 4,000 / 8,000 at £2.5m; low-cost 30,000 / 80,000 at £0.1m	No public baseline; low-cost price not published by makers, so £0.1m is a deliberately high planning figure; large sensitivity
14	Short-range and counter-drone missiles	£6bn / £10bn	Scaled from the current counter-drone line ¹⁸
15	Air-launched munitions	£3bn / £6bn	Judgement, informed by past campaign use ^{62, 236}
16	Standing-capacity fee	8% / 10% of production capital a year, seven years	Norway covenant precedent ¹⁵ ; halved in Case R

#	ASSUMPTION	VALUE	BASIS AND SENSITIVITY
17	Regime cost (revenue forgone)	£2.5bn / £3.5bn over ten years	Built up in Section 10.4
18	Skills, regulators, research, digital	£6bn / £8bn	Judgement
19	Feedstock reserve	£41m / £109m of stock	Companion paper ³⁰ ; the cost table adds two years' running cost
20	UK content of spend	80%	At 50% on the missile line, jobs fall about 15%
21	Jobs ratios	8,600 per £1bn (274,000 jobs on £31.9bn); about 20,000 including induced	Ministry of Defence 2024/25 ³⁵ ; Oxford Economics for ADS, 2008–09 data ¹⁸⁶ ; the induced ratio is an upper bound
22	GDP multiplier	1.0 cautious; 1.5 European evidence	Low-import countries ¹⁸³ ; decisive for the cash figure, not for the asset figure
23	Tax take	37% of GDP	Office for Budget Responsibility forecasts 36–38% ¹⁸⁵ ; average, not marginal
24	Exports	Spare capacity × £5,000 × 1.5	About £2.25bn a year from year 7; halves if prices fall back
25	Export rent to the estate	15% of export revenue	Allied margins of 13–29% ^{21, 27, 191} against a cap near 10%; holds only in a tight market
26	Operator stake	5% (chemical plants); 12% (loading lines)	For the payback illustration
27	Wholesale gas, 2025	£27–34/MWh	79.5p a therm in October 2025 ⁵⁷ ; upper end estimated
28	Asset treatment	Stock at cost; estate over thirty years	National accounts treat ammunition and missiles as inventories ³⁴

