

WASC 2093
WAI 555

The principal UK
Capability for
Explosives, Propellants &
Rocket Motors

RO Explosives
Division ~~Birmingham~~
Westcott

WASC 2003
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Explosives Division

The principal United Kingdom capability for
explosives, propellants and rocket motors



ROYALORDNANCE

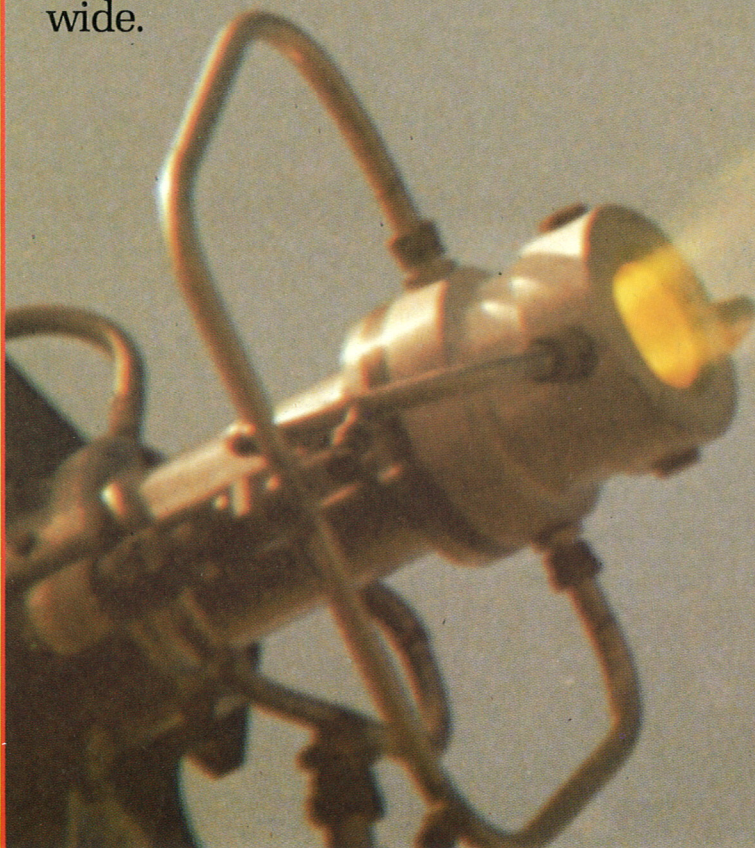
Defence systems, sub-systems and components

THE EXPLOSIVES DIVISION

It was formed in the Spring of 1984 as part of the restructuring of the Royal Ordnance organisation. It is one of four Divisions and its five sites make up the principal United Kingdom capability in the related fields of explosives, propellants and rocket motors.

This totally integrated resource, under a single management structure, represents a powerful industrial force able to serve the Ministry of Defence, prime contractors and other customers in these specialised technical areas. Comprehensive facilities enable a wide range of production activities to be fully supported by research and development capabilities. Fields covered include military explosives, gun and rocket propellants, rocket motors and liquid engines for civil and defence applications, gas generators and combustible charge containers, as well as chemical products used in the explosives industry.

The Explosives Division builds upon the established strength of Royal Ordnance with new expertise, skills and resources to provide an integrated and effective service to defence industries world wide.



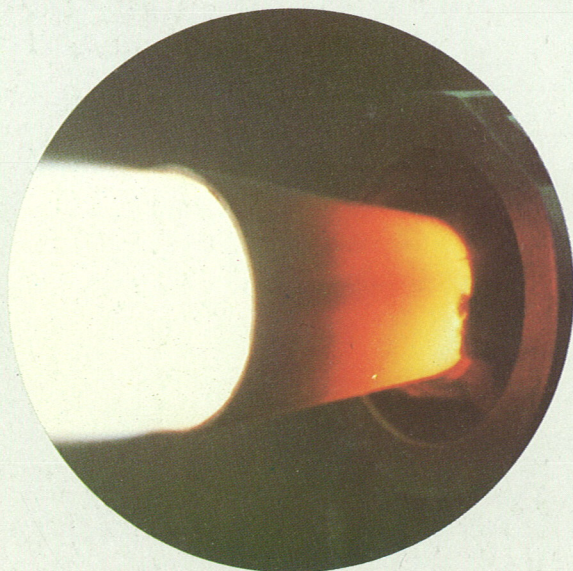
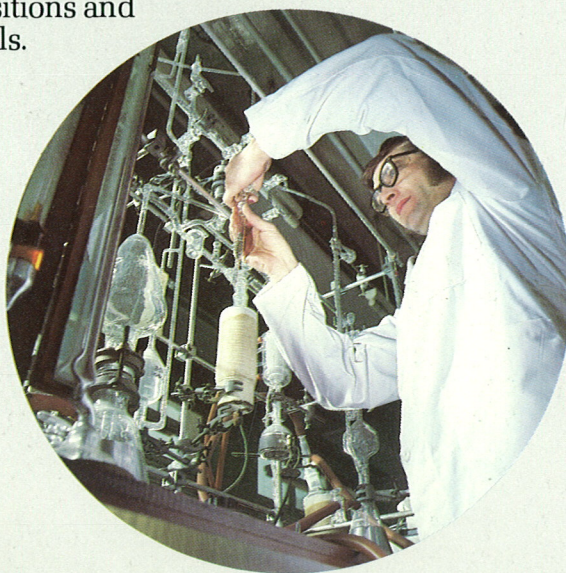


A UNIQUE COMBINATION

The Division's capabilities, facilities and products are generated through five sites in the United Kingdom. These locations possess resources appropriate to their particular expertise with research, design, development and manufacture. This unique combination produces an unrivalled capability in explosives, propellants and rocket motors.

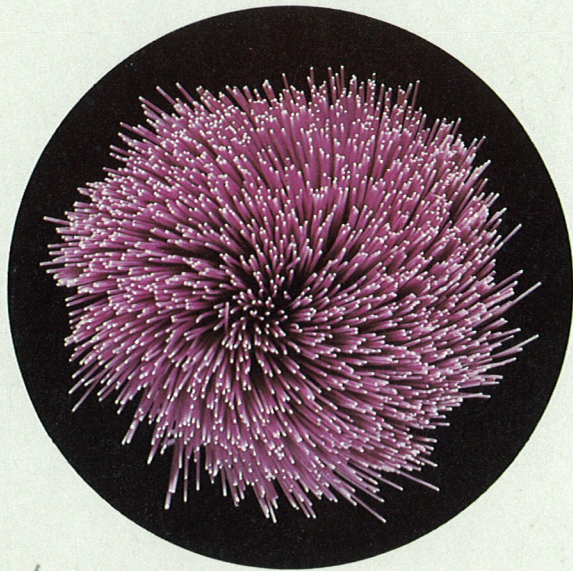
Westcott undertakes design and development, and in selected areas production, in the fields of solid propellant rocket motors, liquid propellant engines, power cartridges and gas generation systems for auxiliary power units. Programmes are supported by research on rocket motor characteristics, ignition, materials of high specific strength, high temperature resistant materials and non-destructive testing techniques; plus a comprehensive range of environmental and test facilities.

Waltham Abbey is responsible for research and development on propellants for guns, small arms and rocket motors, initiatory explosives, high explosive compositions and non-metallic materials. Research facilities range from modern analytical methods for studying the reaction rates in complex systems, to pilot scale and full scale mixing plant. Instruments are available for measuring all the chemical, physical, rheological and ballistic characteristics of propellant and explosive compositions and materials.

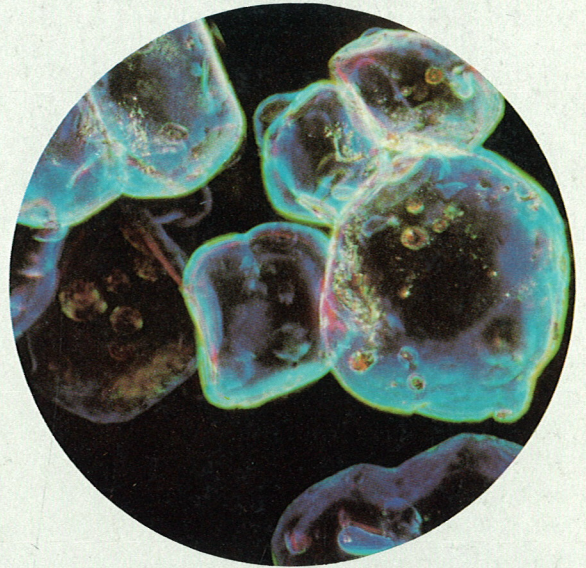




Summerfield – known for many years as IMI Summerfield – is an agency factory of Royal Ordnance operated on its behalf by IMI (Kynoch) Ltd. It is fully equipped to undertake research, design, development and the production of cast double base rocket motors, thrust vector control systems, ammunition protection systems and rocket motor launcher concepts. It is actively involved in research on cast double base propellants and systems, and structural materials used in the manufacture of rocket motor hardware.



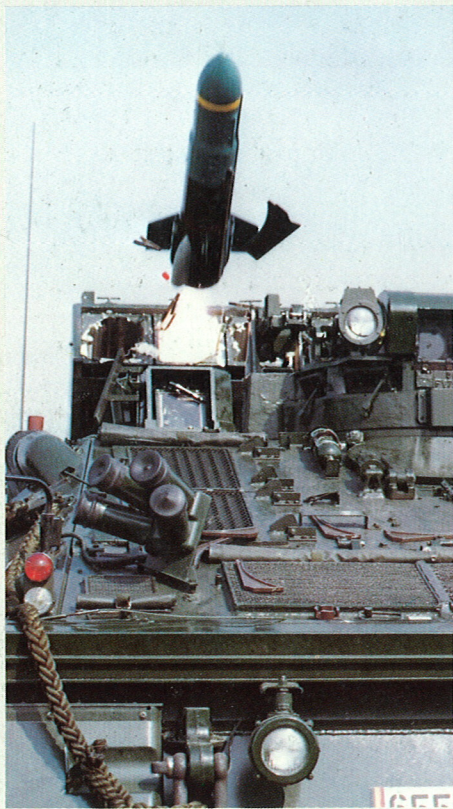
Bishopton is the main UK propellant factory for a wide range of gun propellant compositions and combustible charge containers, as well as extruded and cast double base propellants for rocket motors. In support of these products the factory manufactures intermediate materials including nitric acid, nitrocellulose, nitroglycerine, nitroguanidine (Picrite) and ballistic modifiers. Other activities include the assembly of rocket motors, the filling of white phosphorous smoke ammunition and the breakdown of ammunition with subsequent safe disposal of explosives and propellant.



Bridgwater is the major UK producer of high explosives for ammunition, warheads, mines etc. Products include RDX (hexogen), HMX (octogen), TNT, TNT based explosives and other specialised plastic bonded compositions, for which intermediate materials, nitric and sulphuric acids and hexamine are continuously manufactured on site. The manufacture of rocket motors, filled with the latest advanced cast and extruded rubbery propellant formulations, is carried out in modern plant of high volume capacity.

ROCKET MOTORS

Rocket propulsion systems The Explosives Division is currently developing and manufacturing a wide range of advanced rocket propulsion systems, based on double base or composite solid propellants and mono- and bi-propellant liquid engine systems. Feasibility and assessment studies are undertaken, proceeding to design and development, and culminating in production. The Division can also arrange to transfer technology, and to establish indigenous testing facilities and production capabilities.



Swingfire guided weapon

The present range of rocket motor performance extends from short duration thrusts of 800 N for 13 ms to 1500 mm diameter motors with thrusts of up to 2×10^5 N for 40 seconds.

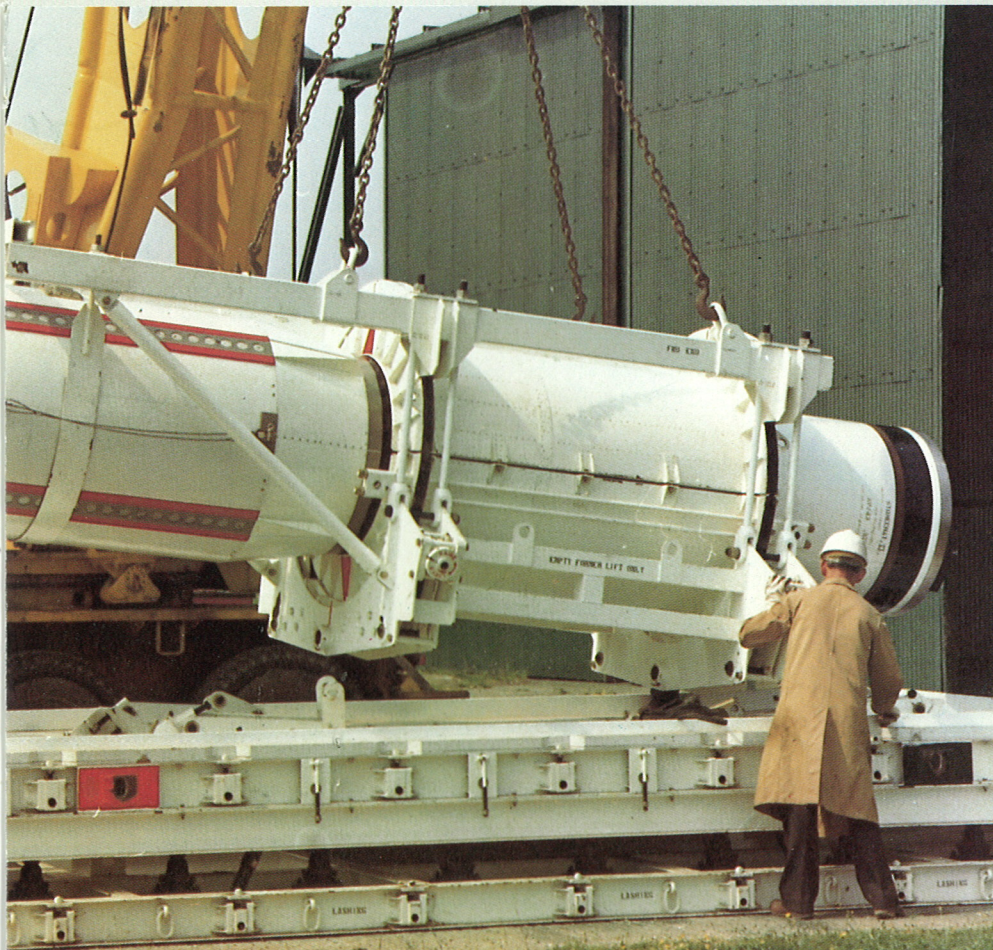
Motors are designed to meet world wide environmental conditions, have long service life, high reliability, low smoke emission and the option of thrust vector control. The stages of design and development are structured to ensure that all rocket propulsion systems satisfy the highest standards for safety and serviceability.



Packaging a large rocket motor



Tracked Rapier missile launch



Rocket Motor

Components A wide variety of techniques and materials for rocket motor hardware is available to meet individual missile requirements, including light alloy, steel and fibre composite cases. Products of the Explosives Division provide the customer with the benefits of special features ● lightweight ● stiffness ● integral wing attachments ● low vulnerability ● quality ● cost effectiveness.

Propellant Charges

Propellant charges can be produced in lengths or shapes to suit customer's application, in diameters up to 1500 mm. They may be cast, extruded or machined, produced loose or case bonded. Performance characteristics include: ● total impulses from 10 to 8×10^6 Ns ● burning times from a few milliseconds ● low smoke signatures ● temperature range -55 to $+70^\circ\text{C}$ ● service life up to 20 years.

Extruded rocket propellant

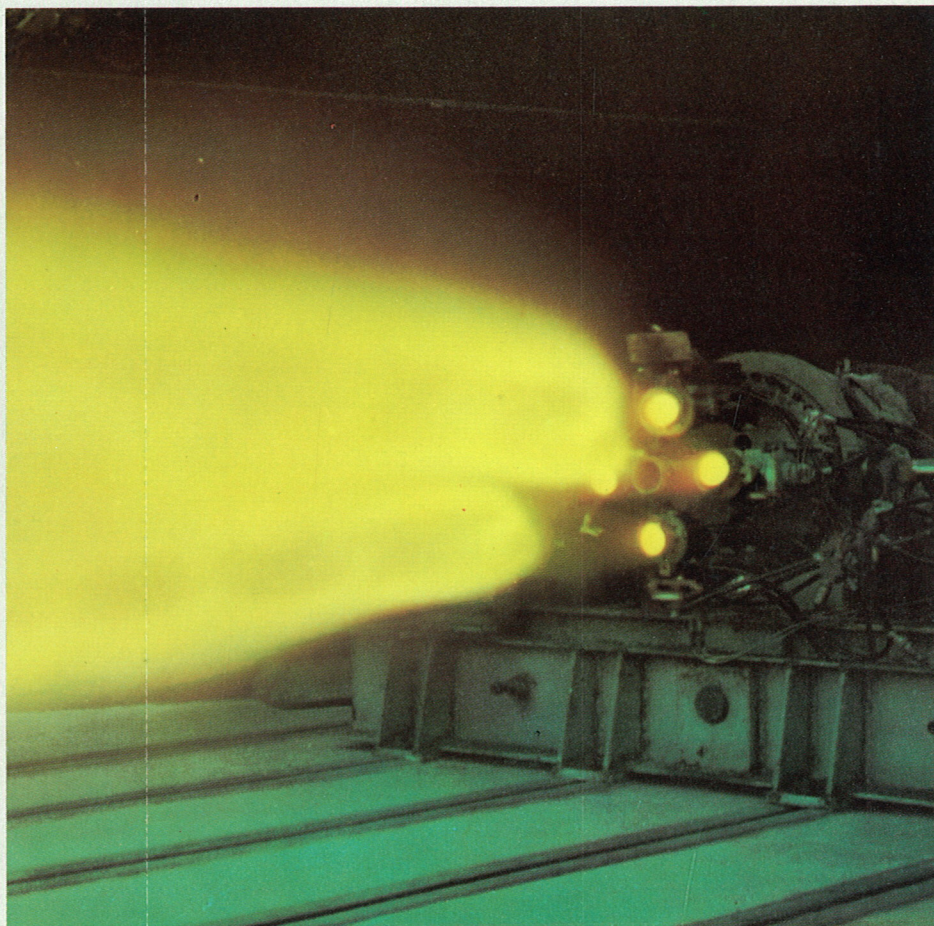


Nozzle Materials and Blast Tubes These components experience the most severe rocket motor environment, high pressure, intense mechanical and chemical erosion, extremely high temperatures and thermal shock. These criteria demand new combinations of existing materials or the development of new ranges of materials, for which the Explosives Division is well equipped.

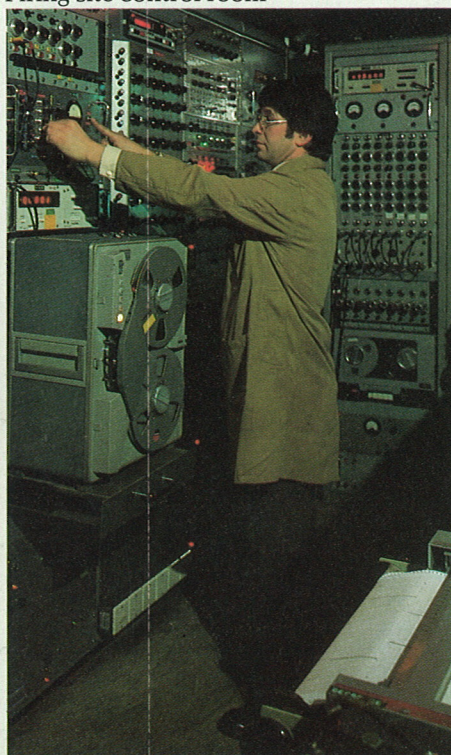
Thrust Vector Control (TVC) Systems Thrust vector control systems are available for immediate and optimised rocket motor application. These include moving nozzles (flexible, swivel, gimballed), spoilers, jet vanes, jetavator and fluid injection. Their application offers ● a vertical launch capability ● high in-flight agility, especially at launch ● pitch, yaw and roll control ● interception at closer range ● add-on modules ● an underwater capability.

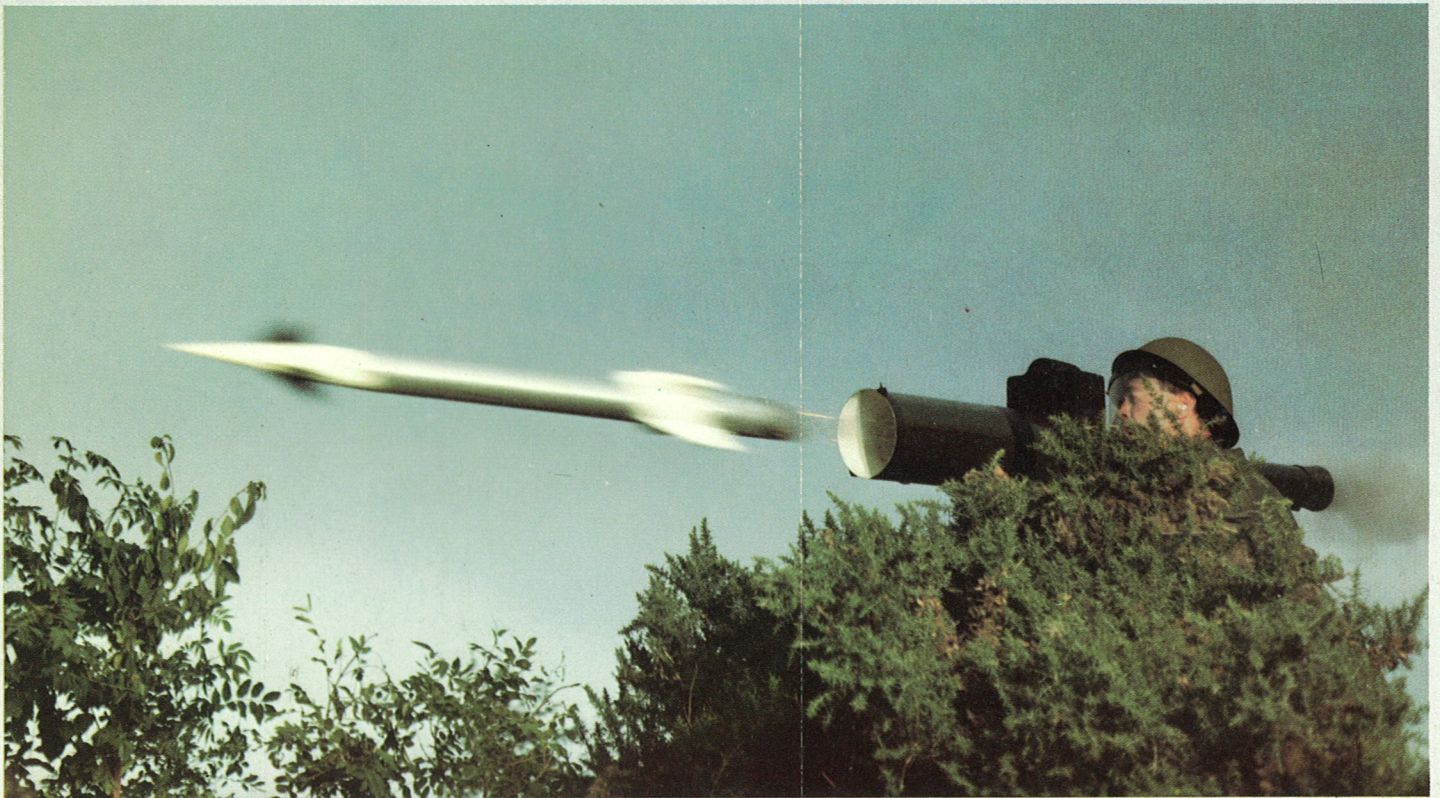
Power Cartridges and Gas Generators Development and production is undertaken on power cartridges and gas generators for power units to provide instantaneous sources of energy for many military and civil systems. Applications include ● ejection of missiles and stores from aircraft ● expulsion of liquid propellants ● expulsion of electrolytes in emergency batteries ● starting of aircraft engines ● the operation of guidance systems in guided missiles and terminally guided sub-munitions.

Fundamental and applied research is carried out to maintain our position in the forefront of this specialised technology.



Thrust Vector Control test firing
Firing site control room

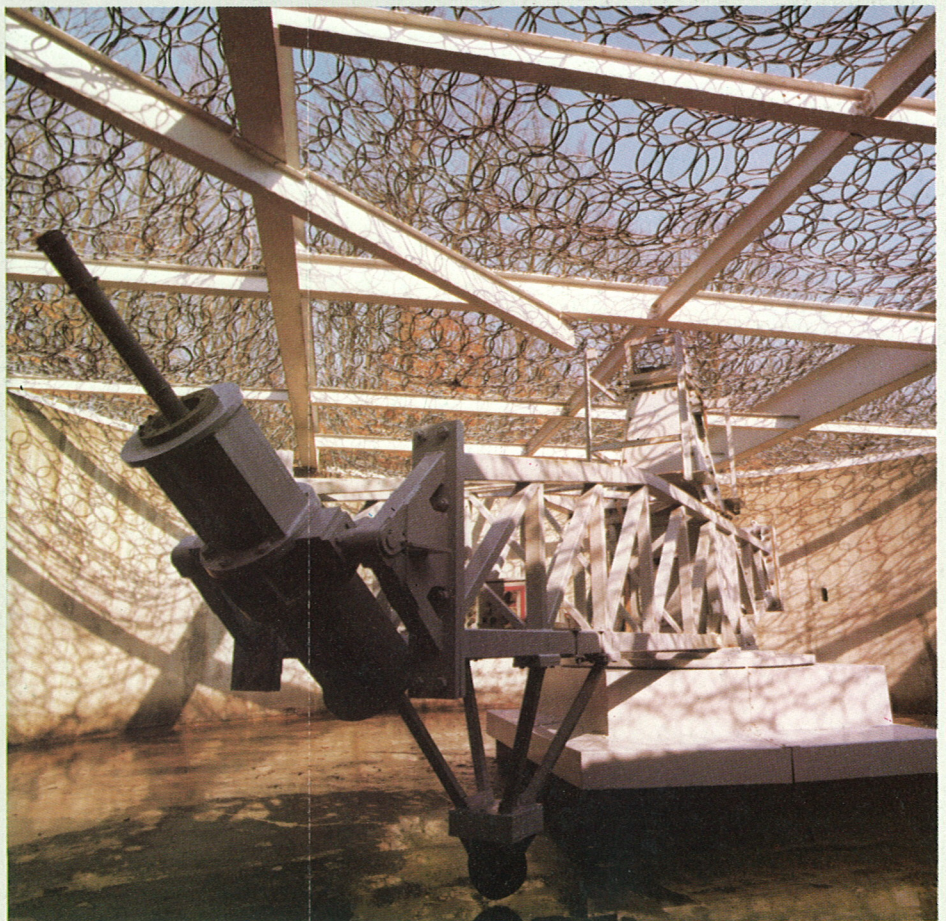
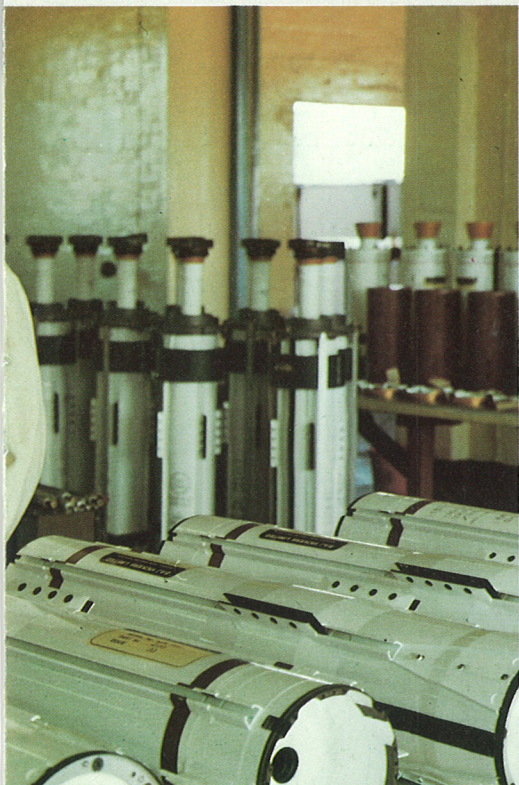




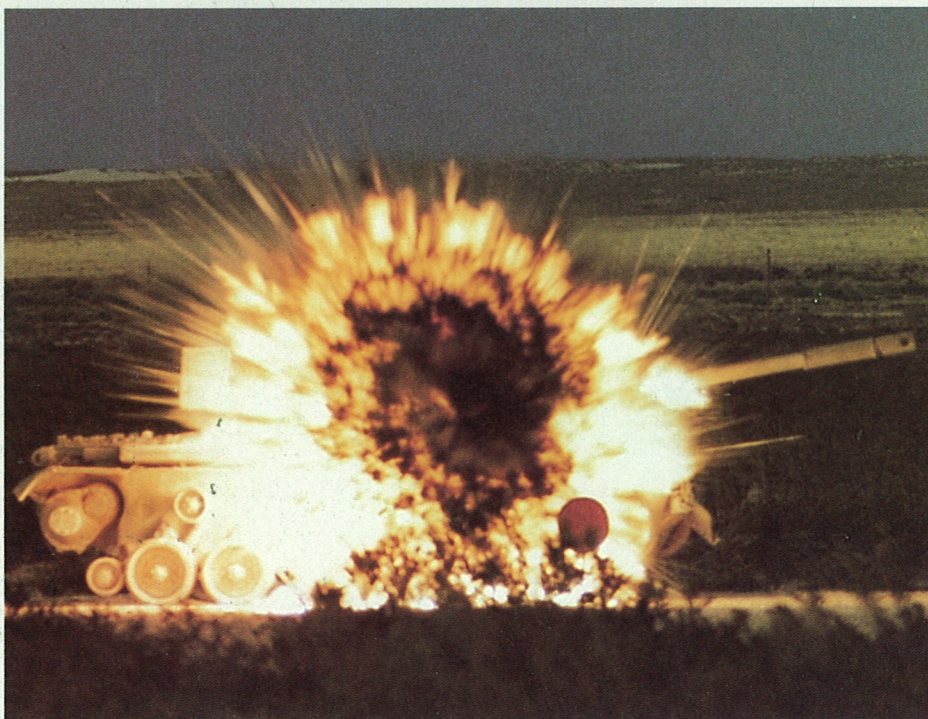
Blowpipe launch

Centrifugal test unit

Seawolf assembly

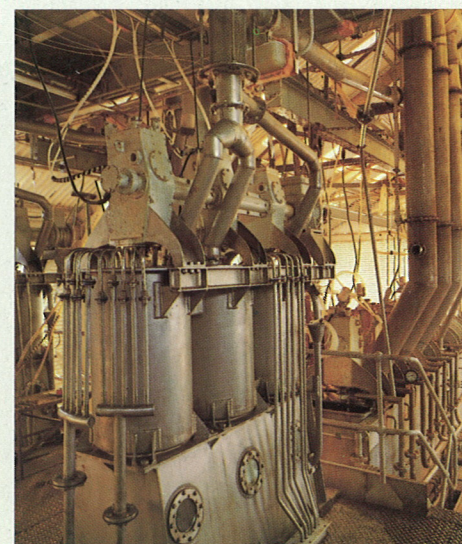


HIGH EXPLOSIVES The most powerful high explosives used for main fillings and charges are RDX and HMX. The Division is able to produce them in absolutely pure form, free of all impurities, by the action of nitric acid on hexamine under appropriate conditions. Filling compositions are then produced by several different desensitising and mixing techniques.



TNT has been an important military explosive for three quarters of a century and it continues to play a variety of roles in the weapons of today. In addition to its use as a carrier for the sensitive nitramines (RDX and HMX), it is used as an explosive in its own right. Its specialised production process – the continuous nitration of toluene – obtains TNT of very high purity. HMX/TNT pour-filled compositions are increasingly specified for shaped charge warheads for guided weapons and bomblets.

Additional expertise and plant is available for the development and production of new and specialised explosives.



Continuous RDX nitration plant

TNT trinitration unit

GUN PROPELLANTS

Gun propellants are manufactured as cords, tubes, slotted tubes and multi-tubular granules as required to produce the specified ballistic performance. Combustible charge containers have replaced bags and metal cases for holding the propellant in certain types of ammunition. They are produced as rigid cylinders based on a nitrocellulose composition which is completely consumed on firing.

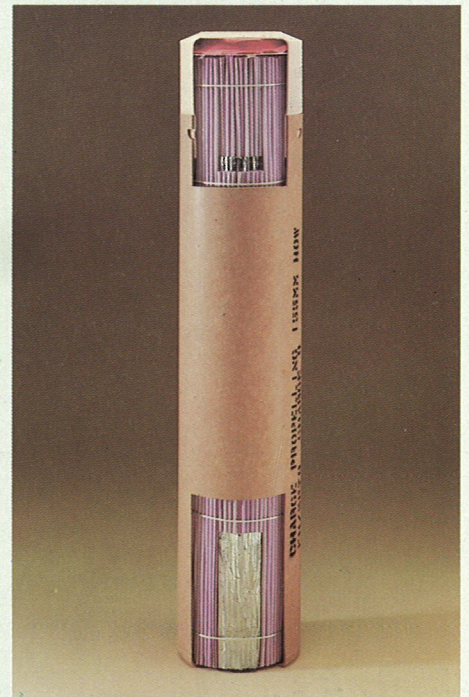
The manufacture of propellants requires the supply of various intermediate materials, most of which are produced within the factory – the first such purpose built establishment in the UK.



105mm Light Gun



Automatic continuous Nitroglycerine plant

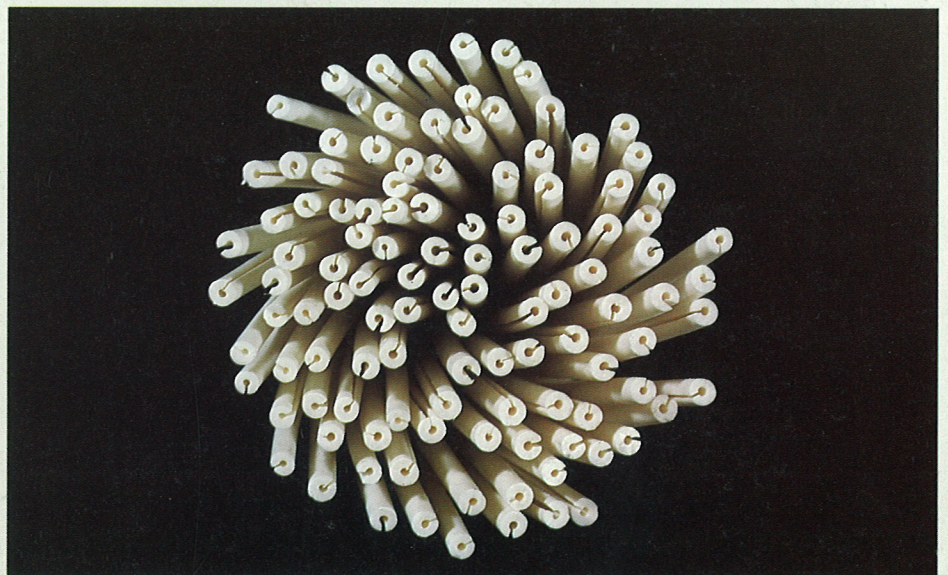


Combustible charge container for 155mm ammunition



Manufacture of combustible charge container felts

Slotted tubular gun propellant



PRODUCT ASSURANCE

Quality through every stage of development and production from raw materials to finished items is controlled in accordance with the appropriate Defence Standards. The nature of the work undertaken in the Explosives Division demands that stringent quality control standards are applied throughout all stages of development and production. The advice of the Ordnance Board is sought to ensure that all products satisfy the highest standards of safety and reliability for world wide service use.

Further information may be obtained from :

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