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WAI 556

Royal Ordnance  
Into the Front Line  
A Corporate Profile



# Into the Front Line

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**ROYALORDNANCE**  
*Defence systems, sub-systems and components*



**Royal Ordnance occupies a unique position within the framework of the UK's total defence capability.**

**It is the largest producer of ammunition in Europe.**

**It is Britain's major manufacturer of armoured vehicles.**

**It is Britain's main designer and manufacturer of tanks, mortars and artillery.**

**It has Britain's only integrated rocket motor capacity.**

**It is Britain's most important producer of small arms.**

**And it is the only organisation in the Free World with the integrated capability to design, develop and make basic components, subsystems and full systems in each of these sectors.**

#### **Vital historical role**

Royal Ordnance had its origins in the Royal Powder Mill at Waltham Abbey in 1560.

Since then, under various names, it has played a crucial part in the defence of Britain.

Its weapons were tried and tested against the Spanish Armada, during the Napoleonic Wars and in the Crimean War. Its design and manufacturing capability grew to meet the demands of Britain's Royal Navy, Army and RAF during the Great War, World War II, and Korea. More recently Royal Ordnance equipment played a decisive role in the Falklands Campaign.

In effect, the development of Royal Ordnance runs parallel to the development of the defence industry in the UK, and this has given it a profound practical understanding of the needs of this country's Armed Forces.

But it has given it more than that.

#### **Unrivalled resources**

Royal Ordnance has built up a level of experience of defence requirements and of conditions around the world that no other defence contractor can match.

And, as a consequence, the company has the capability to design, develop, manufacture and support every aspect of conventional weapons.

The business implications of this are profound.

#### **Commanding capability**

For example, a tank is not just an armoured vehicle. It is an integrated weapon system. Guns, shells, armour, engine, electronics, gear box, tracks, and communications, are all sub-systems within the whole. And those sub-systems, too, break down into further component parts.

Royal Ordnance can design, build and manufacture a complete tank, or it can design and develop virtually any part or parts of a tank to be compatible with systems designed by other companies.

What is true of a tank is true of all other ammunition, weapons, fighting vehicles, explosives and small arms systems.

Thus, with this integrated capability, Royal Ordnance is in a unique position to compete for defence contracts right across the spectrum of its competence. It means it has complete flexibility to work in joint ventures, as a project leader or as a single prime contractor.

#### **Royal Ordnance's cutting edge**

In an industry in which the procurement cycles are marked by long lead times between project inception and completion, Royal Ordnance has an exceptionally strong commercial base.

For years it has enjoyed a unique relationship with the Ministry of Defence. It has always been Royal Ordnance's primary client.

While this relationship has undoubtedly deflected the pressures of pure market competition, it has also produced very considerable advantages.

There are few more demanding customers than the British Armed Forces.

Therefore Royal Ordnance products have been subjected to the most rigorous of tests, under trial conditions and in the field.

As a direct consequence of this, Royal Ordnance products, systems and subsystems are highly regarded by other governments and military purchasers, as the scale of its overseas activities bears out.

#### **On the offensive**

The next decade will produce outstanding opportunities for Royal Ordnance.

A new corporate and management structure has been established and marketing and research and development functions have been fused with Royal Ordnance's highly successful manufacturing capability.

The company is now supremely well equipped to compete openly in the commercial world, and there can be no doubt its immediate and long-term future will be quite as impressive as its past.

#### **Bryan Basset**

*Chairman of Royal Ordnance plc, appointed August 1985 by the Secretary of State for Defence.*





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# The Market for Royal Ordnance

In 1980/81 the UK spent £11,183 million on defence (source: UK Defence Review November 1984).

In 1984/85 the figure has risen to an estimated £17,033 million.

And by 1990 it could reach £20 bn.

Total world military expenditure in 1980 was an estimated US \$563,542 bn. (Source SIPRI Yearbook 1984), of which the UK export share was around 4%.

By 1990 the total could be as high as US\$900,000bn, although it is expected that the volume of export sales of defence equipment will probably fall as unit costs increase.

These figures, in the broadest terms, define the size of the markets in which Royal Ordnance has competed in the past, and in which it will continue to do so in the future.

## Target markets

More precisely these markets break down into three basic types: the sophisticated NATO countries; the non-NATO countries with sound financial resources; and Third World countries with limited resources but specific defence needs.

Given the vertical integration of the Royal Ordnance design and manufacturing base, there are a variety of ways in which it attacks these markets.

## Penetrating markets

There is worldwide demand for its major systems such as the 105 mm Light Gun, 81 mm and 51mm Mortars, Enfield Weapon System, Bar Mine System, and Combat Engineer Tractor.

And by generating higher sales of delivery systems, Royal Ordnance should generate a consequent demand for more consumable products such as ammunition.

Then there are sub-systems such as tank guns, smoke dischargers, radio harnessing, vehicle chassis, fuzes, electronic components, rocket motors and basic propellants that are compatible with equipment developed by other producers.

There are also a number of sub-contracting opportunities involving a wide range of components.

Finally, research and development of new products, particularly of new high technology 'smart' weapons, both on a private venture basis and in collaboration with other defence contractors in the UK, the USA and in Europe, is a priority that is already being addressed.

In fact the budget for research, design and development currently stands at £52 million, and this will rise substantially over the next few years through internal and external funding.

## Achievements overseas

While Royal Ordnance's past relationship as preferred source to the Ministry of Defence has been widely appreciated, its success in penetrating the international markets has, perhaps, been less recognised.

In the last ten years, overseas sales have never accounted for less than 30% of the company's total turnover. They rose as high as 53% in 1976/77 and 1977/78, and last year ran at 36%.

At present orders totalling over £800 million in Africa, the Middle East, North America, Pakistan, India, Europe, and South East Asia are in various stages of contractual evaluation, and there are a further several hundred million pounds worth of highly probable overseas sales through to 1990.

## The crucial importance of the domestic market

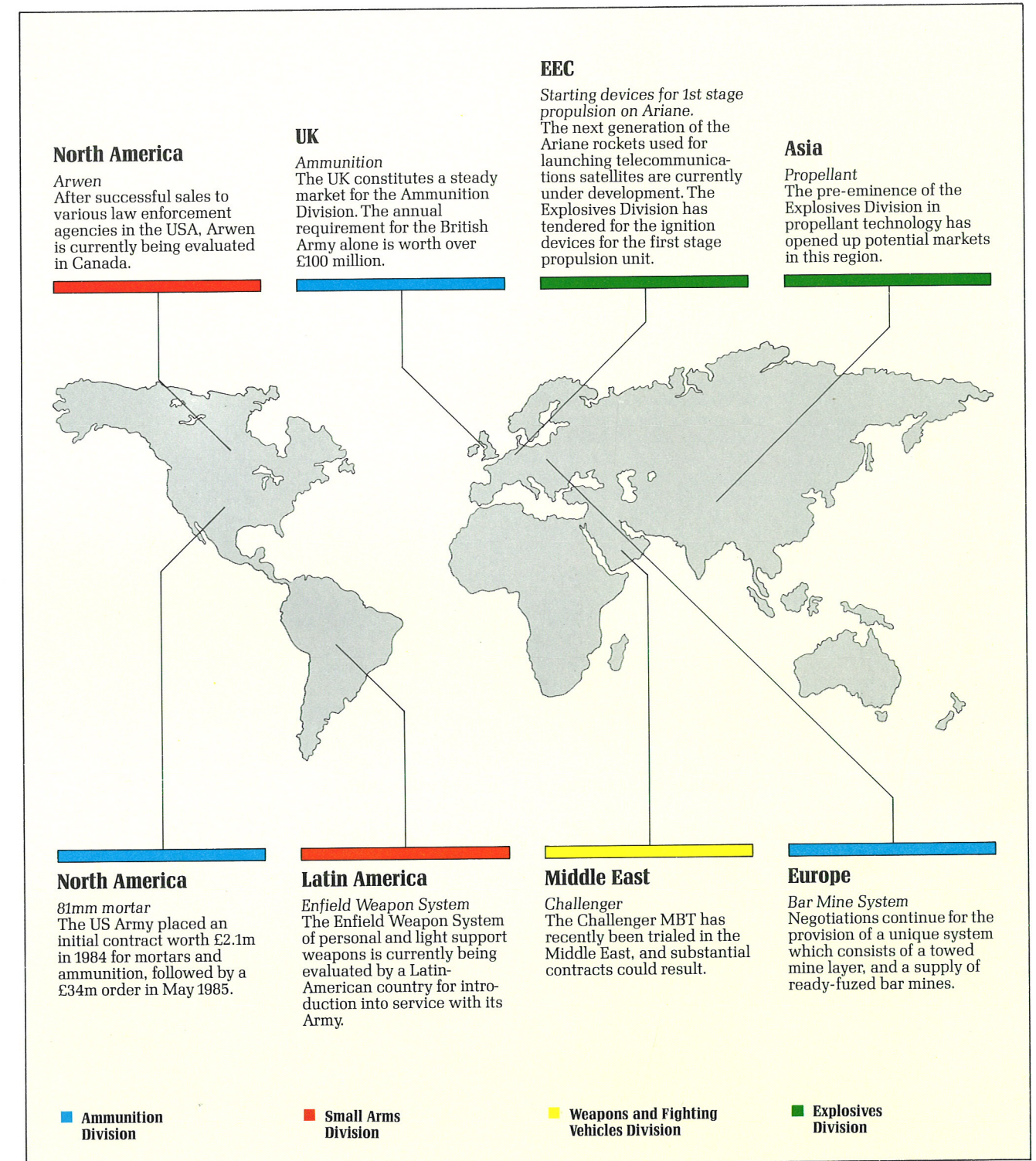
UK defence expenditure has registered steady growth in recent years, averaging 3.5% a year in real terms since 1976. In 1985/86 it is estimated that the country will spend £18,060 million on defence.

Trident will, naturally, account for a significant proportion of this, but as, traditionally, equipment has accounted for over 40% of defence expenditure, there is no doubt that a powerful market exists for Royal Ordnance's products.

Although the perceived view is that loss of the preferred source will be wholly to the disadvantage of Royal Ordnance, the change in the company's relationship with the Ministry of Defence will in fact work very much in its favour. It leaves Royal Ordnance free to co-ordinate research, design, development, marketing and sales policies for precisely defined commercial objectives.

## Potent force

No other defence contractor has more experience of the demands of the British Armed Forces or of the workings of the Ministry of Defence. Released from the commercial restrictions of being a preferred source, Royal Ordnance has developed the full corporate structure needed to harness that experience.





# Management Structure

Royal Ordnance plc was incorporated on the 2nd January 1985, following legislation during 1984. Prior to privatisation, the company will be wholly owned by HM Government with the Secretary of State for Defence as the single shareholder with the power to appoint the Chairman and the Directors. Since incorporation a corporate structure geared to Royal Ordnance's new opportunities has been created.



**Bryan Basset**  
Chairman

Chairman of Royal Ordnance since August 1985. Bryan Basset joined stockbrokers Panmure Gordon and was the partner, institutional sales 1960 to 1965, then corporate finance until 1972. He joined Philip Hill Investment Trust PLC as managing director until his current appointment.

## Commercial orientation

Royal Ordnance plc has been converted into a holding company retaining only financial control and ownership of its assets. The Divisions are now separate companies which operate those assets on the holding company's behalf.

The Divisional structure—Ammunition, Weapons and Fighting Vehicles, Explosives and Small Arms—has been retained, but now each Division and factory is an autonomous reporting centre.

Their progress is monitored, and communication maintained, by the Executive Committee on which the Managing Directors of the respective Divisions and the heads of departments sit. This meets every month under the chairmanship of the Chief Executive.

The Main Board has been reduced for operational reasons. Each non-executive director is responsible for long-term contact with one of the four divisions, and attends divisional executive meetings. This gives the Main Board an independent assessment of the progress of each Division.

## Central resources

Co-ordinated sales and marketing programmes play a major part in Royal Ordnance's development.

To support Divisional sales teams there is a centralised Marketing Department. This has three functions: firstly to undertake market research; secondly to identify market opportunities at home and overseas; and thirdly to co-ordinate Royal Ordnance promotion activities including demonstrations and exhibitions.

Group R&D policies are market led, and these policies, along with procedures and controls, are the responsibility of a central R&D unit which includes a Future Systems Group to identify future strategic defence requirements.

Finally a programme to give Royal Ordnance a coherent and co-ordinated information technology system is being implemented. This will involve spending £22.5 million over the next few years on factory systems hardware, mainframe hardware, office automation, electronic mail, a telecommunications network and design and development hardware.

## Winning business

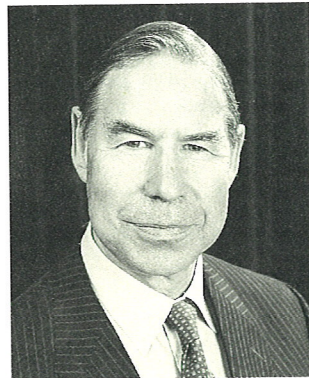
The significance of these developments is that they make Royal Ordnance a strong and flexible commercial organisation oriented to the new market opportunities presented by the move to the private sector.



**Bill Meakin**

Executive Deputy Chairman and Chief Executive

Before entering the Royal Ordnance Factories' Organisation in 1951, Bill Meakin had a successful career in the steel industry. Since 1951 he has worked in all four Divisions that now make up Royal Ordnance. He became Deputy Chairman and Chief Executive in 1985.



**Air Chief Marshal Sir Douglas Lowe GCB, DFC, AFC**  
Non-Executive Director

Appointed Chairman of Mercury Communications Ltd on 1st January, 1984. Air Chief Marshal Sir Douglas Lowe previously held the appointment of Chief of Defence Procurement, with responsibility for research, development and purchase of all operational equipment for the Ministry of Defence.



**Lord King of Wartnaby**  
Non-Executive Deputy Chairman

Lord King has been involved in British industry at a senior level since 1945. Chairman of British Airways since 1981 and Babcock International since 1972, he also sits on the boards of the National Nuclear Corporation; the British Nuclear Association; SKF (UK) Ltd; the Dick Corporation (USA); and the First Union Corporation (USA).



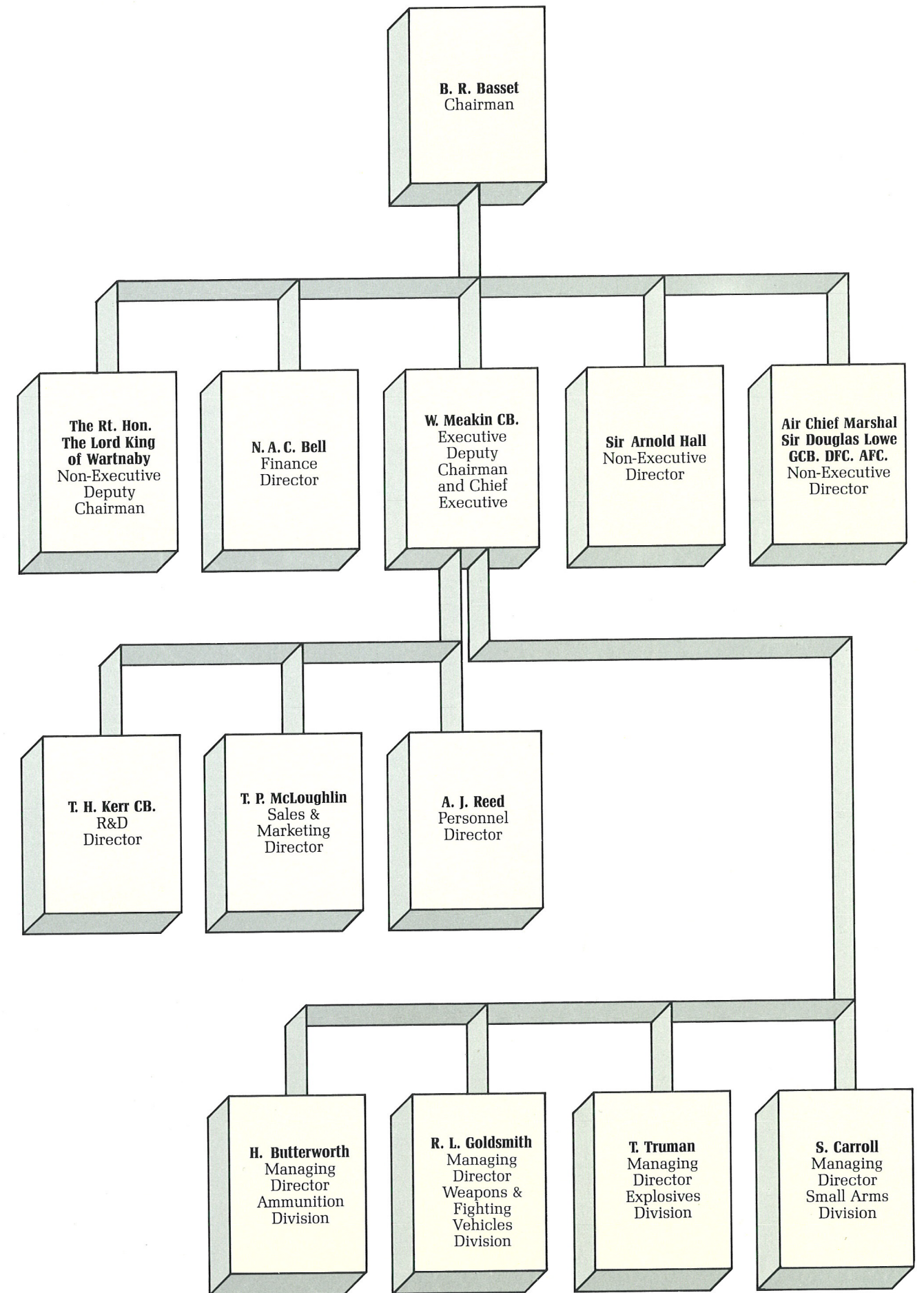
**Nicholas Bell**  
Finance Director

Nicholas Bell started work with Price Waterhouse in 1961 where he became Senior Auditor. Since working in the chemical industry, he has held senior positions in British Leyland, BTR and Plessey where he was responsible for introducing new financial controls. He joined Royal Ordnance in 1983 as Finance Director.



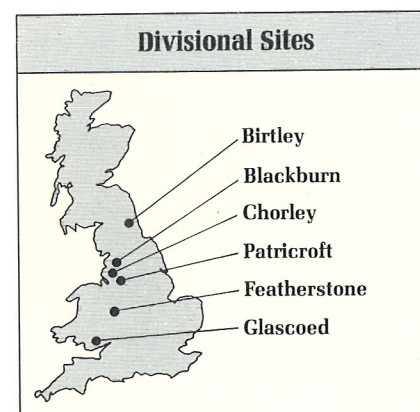
**Sir Arnold Hall**  
Non-Executive Director

Sir Arnold Hall has had a distinguished career in the aerospace industry, in particular with Hawker Siddeley, of which he has been Chairman since 1967. He was also Managing Director between 1967 and 1981. Sir Arnold is also Director of Rolls Royce Ltd.





# Ammunition Division



With annual sales in the region of £240 million including intra-group trading, the Division accounts for 60% of the total output of the UK's ammunition industry.

The Division, which manufactures ammunition over 30 mm, is not just the largest volume producer in Europe. It has a product range unequalled by any other ammunition manufacturer in the world.

Increased competition is unlikely to affect anything other than a small percentage of home sales of ammunition, given the monopoly which the Division enjoys for so many of the requirements of its main customer, the Ministry of Defence.

On the other hand the stringent testing and approval procedures dictated by the world respected Ordnance Board means that many overseas customers are prepared to pay a premium for Royal Ordnance products over those from lower cost competitors.

## Matching market developments

Although in general terms, the ammunition requirements of the more sophisticated users are in transition to more advanced natures, demand for its traditional products will stand up well both at home and overseas.

Because of technological pre-eminence in the field the Division has, for example, been able to increase significantly the range of the 155 mm howitzer through developing a more efficient charge system. This enables those countries which made a major investment in artillery systems some years ago to upgrade the performance of their artillery without being involved in further major capital expense.

Harry Butterworth  
Managing Director

## In the vanguard

In addition, the Division has a highly developed R&D capability involving over 600 staff, and it is well equipped to tackle markets for more advanced weapons on its own or in collaboration with other contractors.

For example, it is working with the Small Arms Division on LAW 80, a light anti-armour weapon under the project leadership of Hunting Engineering Limited, who are also prime contractors on another Ammunition Division product, the low altitude airfield attack weapon JP233.

MLRS - the Multiple Launch Rocket System - is an American designed weapon on which Italy, France and West Germany are collaborating with the UK in producing it for their respective NATO forces. The Division is a major sub-contractor.

It is developing a Vehicular Intercom System (VIS) with E-Systems Inc. of the USA to meet the needs of the US Army well into the next century.

And then on its own, or in conjunction with other Royal Ordnance Divisions, the Ammunition Division is involved in the Chieftain/Challenger tank rearmament programme (CHARM) through developing ammunition for the new 120 mm gun. Additionally it is developing a new range of war-heads; safety and arming systems for a range of guided weapons; and an improved range of artillery ammunition.

Above all the Ammunition Division stands to benefit massively from any prime contractor projects won by other parts of Royal Ordnance.

## The potential

At present the Ammunition Division has a relatively small share of the world market, around 3%

With direct control over its own salesforce the opportunity to pursue sales objectives, and the means to control both sales and product development, the Division is well placed to build on that figure.



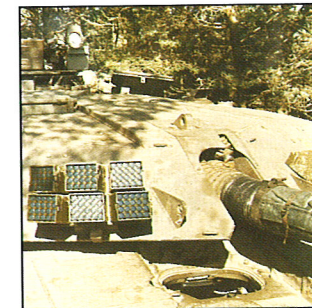


The Ammunition Division specialises in the design and manufacture of all types and natures of ammunition from 30mm to 155mm. With conventional tank, artillery and mortar ammunition, advanced missile warheads, grenades and sophisticated pyrotechnic devices, the Division fulfils a major role in meeting defence needs both as a prime contractor in its own right or as a subsystem and component supplier.

The BL755 system is part of the armament of the F4 Phantom. It is a free-fall cluster bomb which contains 147 bomblets to produce a uniform elliptical ground pattern for use against parked aircraft, light-skinned vehicles, artillery and troops.



Underwater systems are produced in partnership with Marconi Underwater Systems and the Sting Ray Torpedo is being procured by the Royal Navy and overseas customers.



The unique VIRSS (Visual and Infra Red Screening Smoke) represents a major advance in the protection provided for armoured fighting vehicles against modern surveillance and target acquisition devices. This unique screening system was selected by the British Army after extensive comparative trials.



The JP233 airfield attack and denial weapon is another example of the Division's close co-operation with Hunting Engineering. The HB 876 minelet designed for JP233 is currently a strong contender for inclusion in a major US programme.



A BL755 cluster bomb being assembled at Glascoed.





In 1985 £9m was budgeted by the Division for R&D work into new generation sophisticated high technology weapons.

Design, development and production of advanced warheads is carried out at Patricroft.



The new LAW 80 anti-armour weapon produced with Hunting Engineering has involved the Division in a major design and development programme. The total systems integration will now take place at the Chorley site.

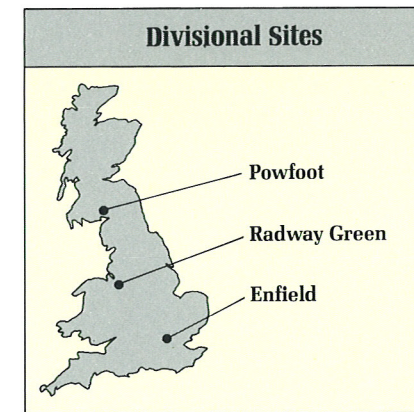
◀ The 105mm Light Gun being loaded and fired under field conditions. The Ammunition Division makes a High Explosive Shell, Smoke Base Ejection Shell, and an Illuminating Shell for the Light Gun.



With a range of between 100 metres and 5650 metres the 81mm Mortar has outstanding performance in terms of range, accuracy and effect that has kept it pre-eminent in its field.



# Small Arms Division



1985 marked the beginning of an exciting new stage in the development of the Small Arms Division which makes weapons and ammunition up to 30 mm. It saw the introduction into service of the first of the initial order of 175,000 Enfield Weapon Systems (EWS), the British Army's basic infantry combat weapon for the 1980's and 90's, and its first new rifle for over twenty years. But Enfield is also working on four other major weapons - the spotting rifle for the Light Anti-Armour Weapon (LAW 80); the Multi-Purpose Weapon (ARWEN); the Hughes Chain Gun<sup>®</sup> machine gun (made under licence), the 25 mm Aden aircraft cannon; and the new calibre 5.56 mm ammunition.

Together these represent a new generation of the Division's products, the subsequent development and sale of which form the basis of its commercial prospects for the next decade.

They will be manufactured at the Division's factories at Enfield (small arms), Radway Green (small arms rounds and components for larger calibre ammunition) and Powfoot (propellants and powders). These employ 3,500 people and account for £100 m of Royal Ordnance's total sales, including intra-group trading.

In the past the Ministry of Defence accounted for 90% of the Division's turnover, and there is no doubt that it will continue to be a major customer.

### Attacking home and overseas markets

On the home front the Aden 25, a development of the successful Aden 30, has already been selected as the 25 mm cannon armament for the RAF's Harrier GR5 jump jet.

The Hughes 7.62 mm Chain Gun<sup>®</sup> machine gun has been selected for mounting on the latest generation of British combat vehicles, including MCV-80.

The British Army is soon due to start receiving LAW 80, and will require an estimated 250,000 in total.

The Division is also vigorously pursuing export sales. Aden 25 is being evaluated for aircraft in Japan and Brazil. There has been considerable interest in ARWEN among law enforcement agencies around the world and sales have been achieved in the USA and other countries. The EWS is currently being tested by a number of countries.

### Generating growth

The Small Arms Division differs from the other Divisions in that it is more self-contained. Over £50 million has been spent since 1979 modernising the production facilities at Enfield and Radway Green, and further significant investment is being made. Radway Green is now the most modern ammunition producing site in Europe.

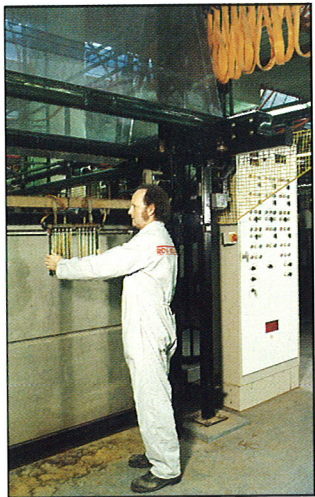
The Division has its own R&D capability involving 74 employees and a turnover of £6 million. Development work has already started on improving the performance of the EWS, on producing lightweight ammunition for Aden 25, on a new rifle for Cadet forces, and on ACE, a single shot version of ARWEN.

Given the degree of acceptance the Division's products have already received, and the strengthened management and marketing capability of Royal Ordnance, there is considerable confidence in its ability to win orders from MOD and elsewhere in a competitive and commercial environment.



**Stan Carroll**  
Managing Director



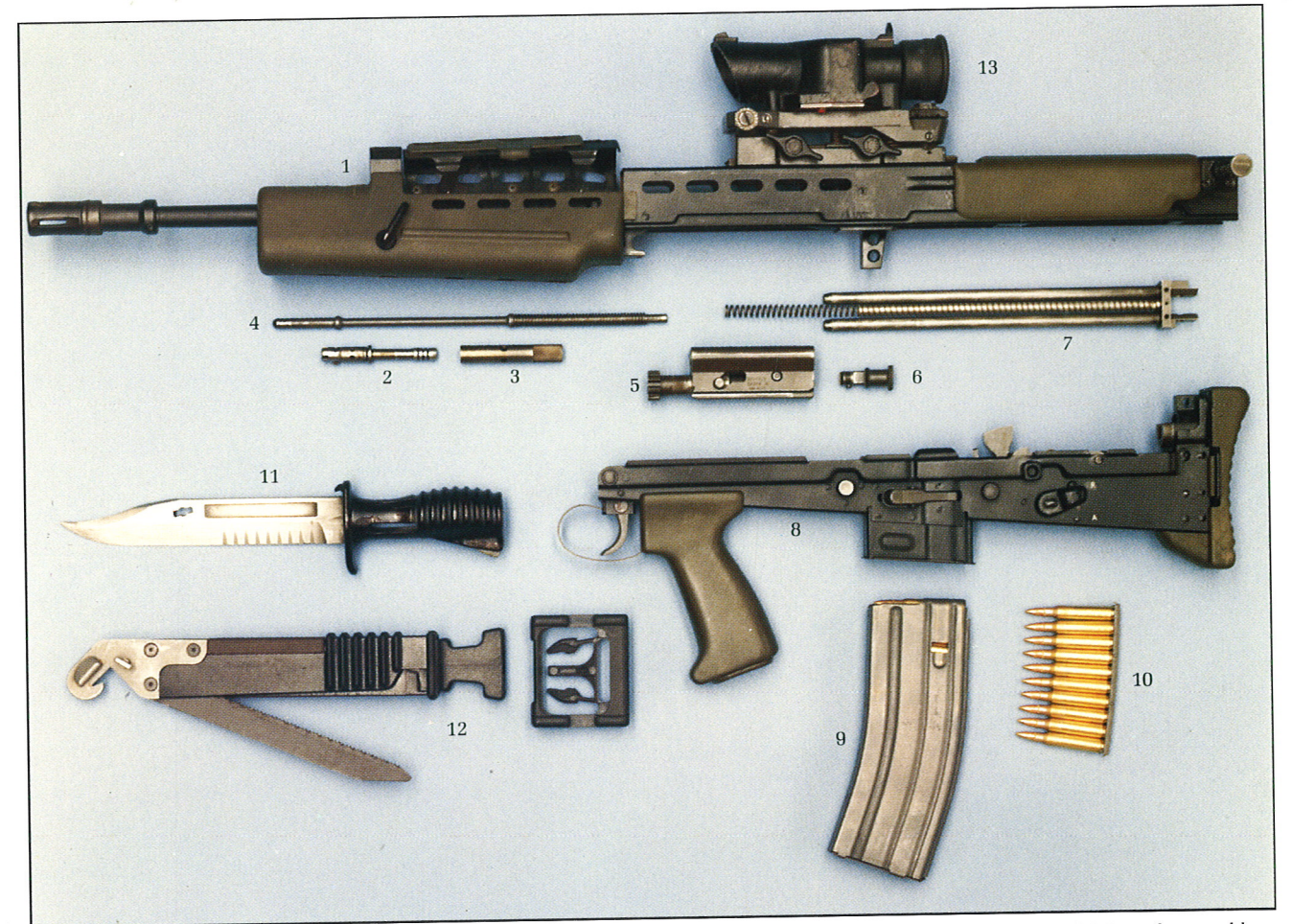


High volume quality manufacture demands stringent process control. There has been an extensive £50m modernisation programme at Enfield and Radway Green, making them among the most modern small arms and ammunition manufacturing sites in Europe.



The Division has the world's most advanced small arms ammunition plant combining high volume production with consistency of quality.

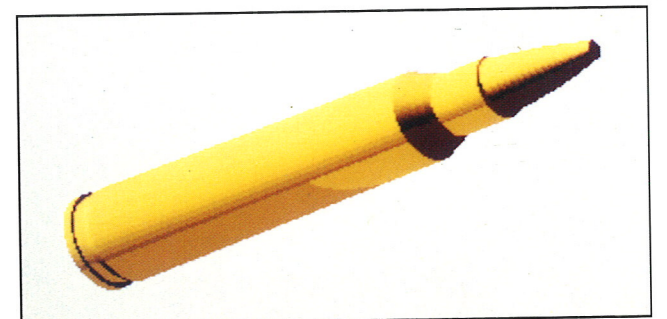
The Enfield Weapon System (EWS) is the British Army's new personal weapon. Designed around the NATO standard SS109 5.56mm ammunition, it weighs 4.98Kg fully loaded, with a 30 round magazine and SUSAT sight.



Major sub-assembly and component parts of the EWS Individual Weapon.

1. Barrel and body assembly.
2. Gas system.
3. Gas cylinder.
4. Piston rod.
5. Breech mechanism assembly.
6. Cocking handle.
7. Recoil rod assembly.
8. Trigger mechanism assembly.
9. Magazine.
10. 10 round charger.
11. Bayonet.
12. Scabbard.
13. Sight Unit Small Arms Trilux (SUSAT).

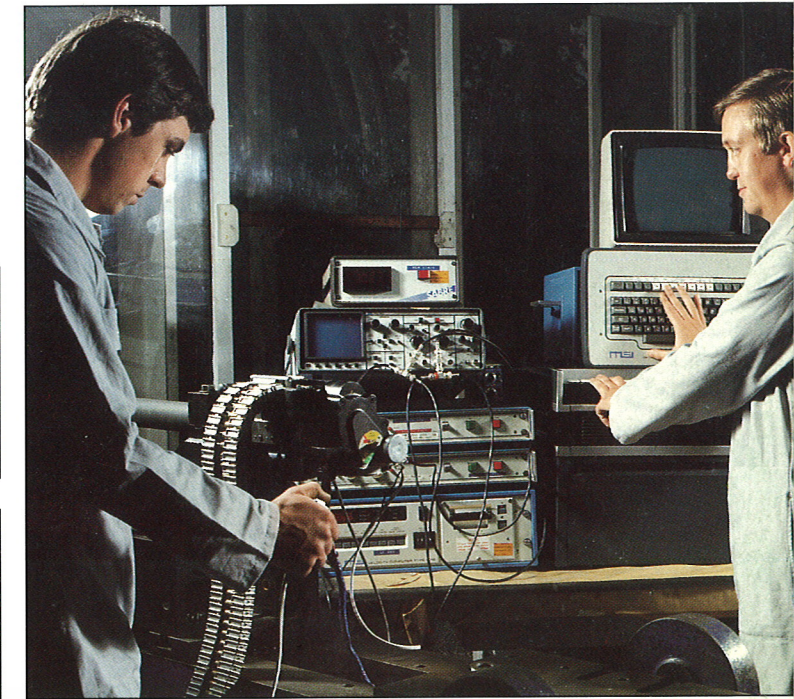
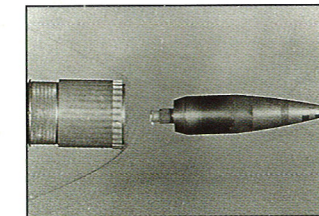
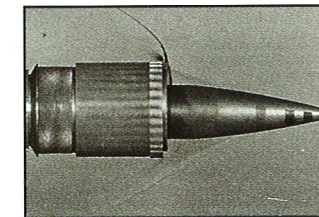
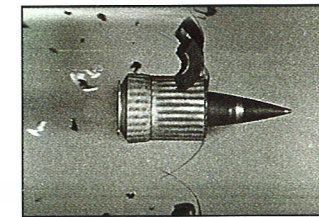
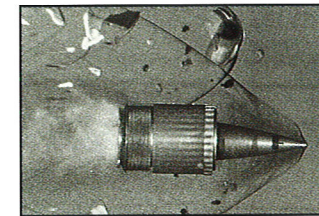
Computer generated solid modelling techniques are used extensively to validate optimum ballistic performance of small arms ammunition.







◀ Small Arms technology embraces:  
 1. The Hughes 7.62mm Chain Gun® machine gun.  
 2. General Purpose Machine Gun.  
 3. EWS Light Support Weapon.  
 4. EWS Individual Weapon.  
 5. Arwen 37 Multi-purpose Weapon.



Test firing the Division's new 30mm armour piercing discarding sabot round. It is effective against the frontal armour of all armoured personnel carriers in service now and in the foreseeable future.

Extensive calibrated range instrumentation is designed for research work and for constant monitoring of product performance.

The Aden 25 Cannon was developed from the highly successful Aden 30. The Aden 25 is an air-to-air or air-to-ground weapon with a fire power (1850 rounds per minute) to weight ratio unmatched by any other 25mm calibre cannon system. It has been selected for the Harrier GR5, and is under consideration for current Jaguar and Hawk projects.





# Weapons and Fighting Vehicles Division



Nothing illustrates the unconventional nature of the defence markets better than the history of the 105 mm Light Gun.

It originally entered service with the British Army in 1974, and quickly achieved wide recognition as being far superior to any comparable weapon.

However, in spite of significant sales in the Middle East and Africa, it was not until its critical testing in combat during the Falklands Campaign that recognition began to lead to interest from other NATO countries.

Now, ten years after its first introduction, there is a strong US Army interest in the 105 mm Light Gun, and there is keen interest in France and Belgium as well.

The lead time for successful sale of the 81 mm Mortar has been even longer. The mortar first entered service in 1964, providing the British Army with marked superiority in this area. In 1985 it began enjoying similar success in service with the US Army.

## Decisive qualities

What both of these examples confirm, however, is that Royal Ordnance produces weapons that hold their place in the face of the fiercest competition through the unremitting application of the highest standards of design and manufacture, combined with competitive pricing and precise market positioning.

The Division's resources are divided between the factory at Leeds where main battle tanks (MBTs) and other armoured vehicles are designed, developed and manufactured; and the Nottingham factory where guns, mortars, rocket launchers, engineer equipment and special vehicles are developed and manufactured.

Together they add up to this country's primary armoured vehicle and ordnance resource.

## On the move at home and overseas

The relatively high profile of this Division can be largely attributed to success of the Challenger MBT for the British Army of which a number have been delivered; and of MBT sales to Middle East customers. Naturally these have made a major contribution to the total sales. In addition, a number of Combat Engineer Tractors have been recently sold to the Indian Government and are in production.

Work has already begun on designing the successor to Challenger. In keeping with the Government's new policy, this will be put out to competitive tender. Given the Division's past experience of MBT manufacture and integrated design and production capability it is well placed to win that competition.

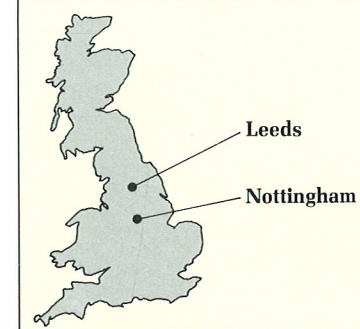
## On target at home and overseas

On the ordnance side, the Division is even more active.

As well as the interest in the 105 mm Light Gun and the 81 mm Mortar, regunning of the T55 tank for Egypt is due to begin; the Division is collaborating with BMY in the USA in the development of an improved M109 self propelled gun; it is developing a 120 mm gun for the UK CHARM programme; it has collaborated with Cadillac Gage in the USA in the development of the 105 mm Low Recoil Force gun; and Brazil has chosen the 105 mm L7 gun for its new Engesa EET-1 Osorio tank. It is already fitted on West German Leopard 1 tanks, the Vickers MK 1 and Mark 111 and the US M-1 (Abrahms), M-60 and M-48 tanks.

With a more aggressive approach to overseas markets now possible, a co-ordinated sales policy, and up-graded funding for R&D, the future of the Division is on a sound footing.

## Divisional Sites

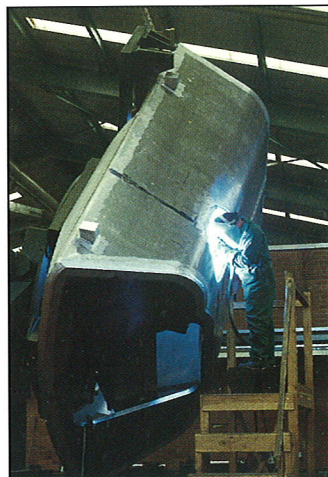


Ron Goldsmith  
Managing Director





The Royal Ordnance factory at Leeds has the UK's largest and most comprehensive tank manufacturing facilities. Centurion, Conqueror and Chieftain Main Battle Tanks for the British Army and export were built here, and the Challenger MBT remains in production for BAOR.



Welding the turret structure for the joint UK, German, and Italian self-propelled 155mm SP70.



Royal Ordnance has designed a family of regunning kits to improve the effectiveness of the Russian- and Chinese-built T series battle tanks. At present, work is being carried out on the T55 tanks of the Arab Republic of Egypt.



The new computer controlled gun forge at Nottingham has significantly improved the Division's capability to manufacture high quality barrels from 76mm to 155mm.

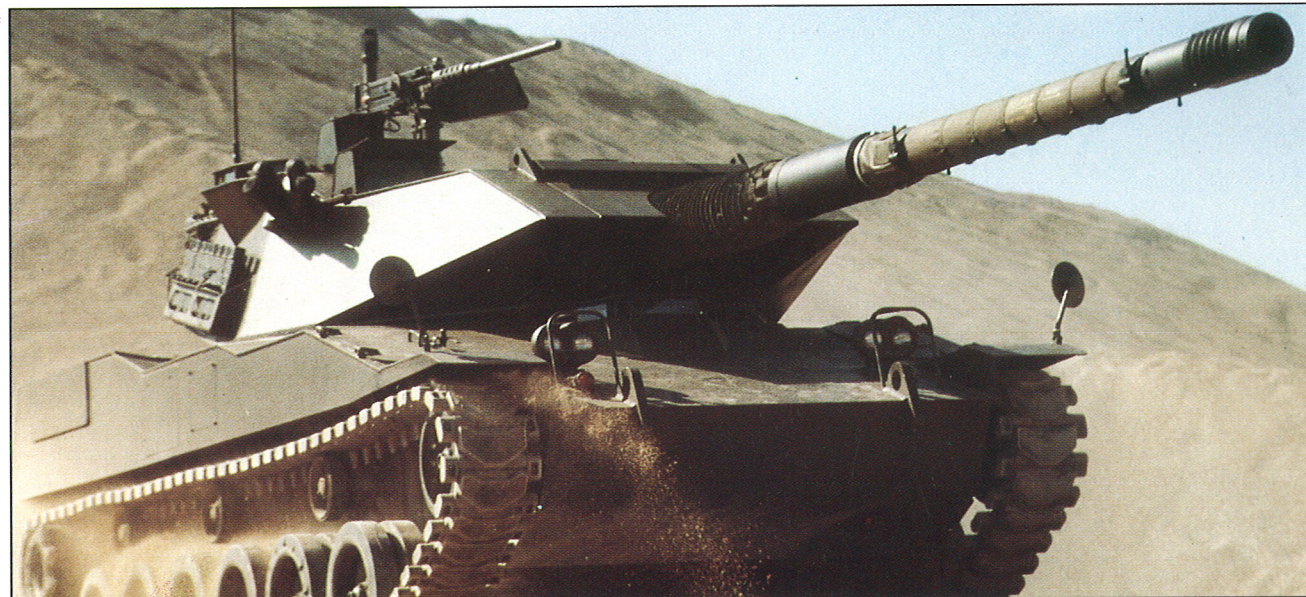
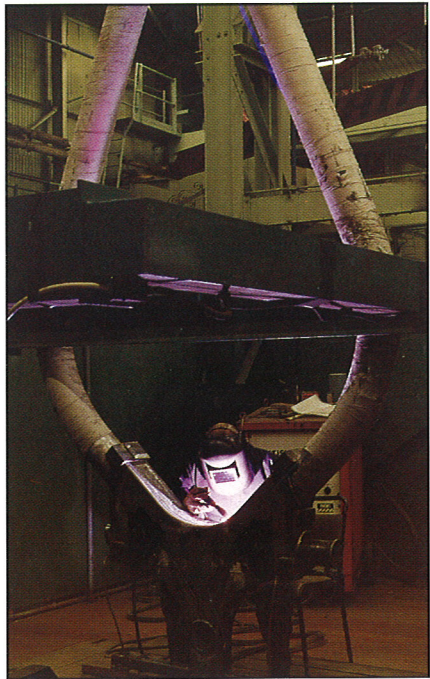


With a 1200 BHP Rolls-Royce Engine, automatic transmission, hydrostatic steering and hydrogas suspension, the Challenger MBT is an immensely versatile fighting vehicle. Challenger has convincingly demonstrated its ability to operate in the demanding conditions of the Middle East during recent hot weather desert trials.



The Challenger is the Main Battle Tank of the British Army. Its Chobham armour provides an unrivalled level of protection. Its 120mm L11 rifled gun has a range of up to 8000m. It can maintain an average speed across country of 40 km/h.





1 To achieve the required combination of lightness and robustness for the 105 mm Light Gun necessitated the use of special materials and new techniques: here the welding of stainless maraging steel is taking place.

2 The Light Gun has proved to be one of the Division's great successes. Introduced into service in 1974, it came to the fore during the Falklands Campaign, where it proved to be the most advanced field artillery system in the world. It is 6.63 metres long. It weighs 1860 kg and has a maximum range of 17.5 km.

3 In service with the British Army and 37 other armies, the 81 mm Mortar has now been procured by the United States Army after a most extensive and thorough evaluation programme.

4 The 105mm Low Recoil Force Gun, a version of the well-proven L7 Tank Gun, mounted on a Cadillac Gage Stringray light tank.



This 4.5" gun, and range of ammunition, are used in the Vickers MK VIII automatic turret built for the Royal Navy.



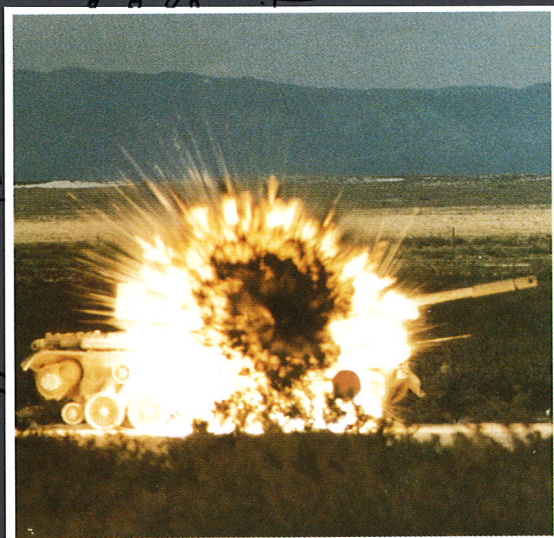
During the last 12 hours of the Falklands Campaign the Army's 105mm Light Guns fired over 250 rounds each. This was made possible by the hydro-pneumatic recoil system being tested here.

The Combat Engineer Tractor will move earth, lay bridges, lay track, cross water, lift and tow other vehicles by night as well as by day. It has proved its effectiveness in service with the British Army. It has been bought by the Indian Army.





# Explosives Division



The development of the Explosives Division will be one of the most interesting features of the progress of Royal Ordnance over the next few years.

Indeed the Division's name disguises the area of its greatest potential—the development of rocket motors and propellants.

The Division already makes the Troy dual thrust motor and casing for the Rapier Missile; the Chow Boost Motor for Sea Dart; the extruded double base propellant and rocket motor for Javelin; and cast composite propellant for the Nuthatch motor for Alarm and the motor for LAW 80.

## Technological leadership

In fact the Division comprises the largest integrated rocket motor design and manufacturing facility outside the USA.

Created originally from two Royal Ordnance Factories at Bishopton and Bridgwater, together with the Westcott and Waltham Abbey sites of the Ministry of Defence's Propellants, Explosives and Rocket Motor Establishment (PERME) R&D facilities and the factory at Summerfield, the Division accounts for roughly 20% of total sales.

Unlike the other Divisions, Explosives is largely an indirect supplier to defence end-users. The greater part of its products go to other manufacturers to become components in their systems. In fact the Ammunition Division accounts for 40% of sales from the Explosives Division.

Its primary expertise, therefore, lies in developing these components to very precise specifications.

## Ahead of the world

As its name suggests, the Division's original product range was comprised of high explosives (TNT, RDX and HMX) and gun propellants.

The demand for RDX is likely to diminish in the foreseeable future, certainly within the UK, although some overseas markets still maintain their potential.

On the other hand there is a worldwide shortage of the more technically advanced HMX, and the Division's factory at Bridgwater is well equipped to exploit the situation.

Gun propellant is manufactured at Bishopton where expertise in stick propellant and rocket motor propellant technology and internal ballistics gives the UK a world lead in the area, and Royal Ordnance a powerful sales advantage.

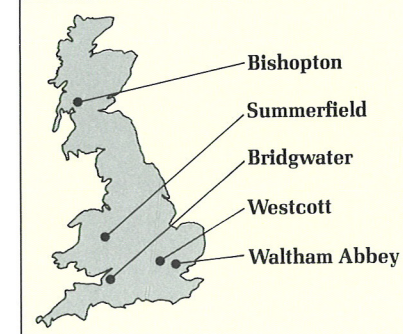
## The way ahead

But it is in the development of rocket motors that the Division's most exciting prospects lie.

Based on R&D facilities that involve almost 900 people throughout the Division, there are already collaborative projects at a national level (principally with British Aerospace's Dynamics Division) and internationally (Trigat medium range missile charge).

In fact the comprehensive nature of its capabilities in solid rocket motor charge design and motor sub-system development puts the Division on a par with all but the largest US contractors in the defence field. It is already emerging as a major contributor to the UK's guided weapons and rocket motor industry.

## Divisional Sites



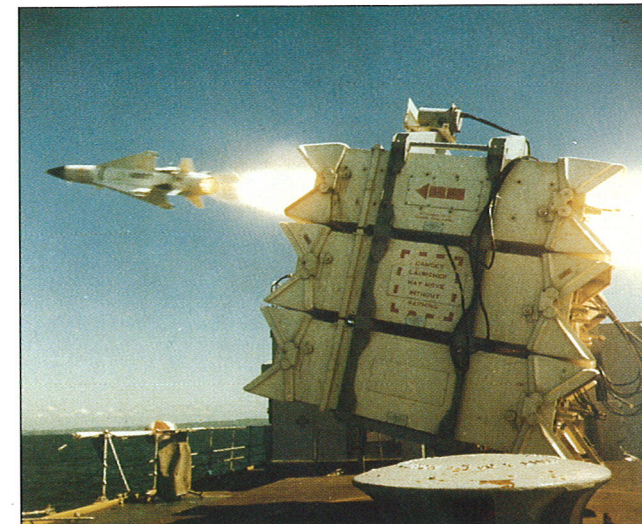
**Trevor Truman**  
Managing Director



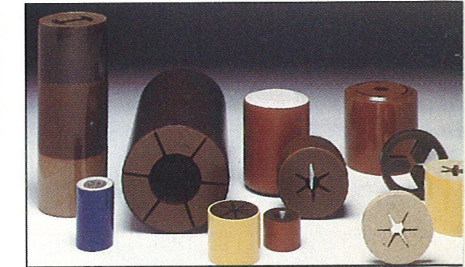


Tornado, whose missile ejection system uses power cartridges designed, developed and manufactured by Royal Ordnance, launching a Sky Flash missile for which an improved boost/sustain rocket motor is being developed.

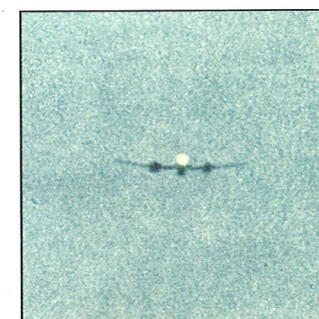
◀ Royal Ordnance is a major sub-contractor for the European-built Self Propelled Loader Launchers (SPLL) for the US-designed Multiple Launch Rocket System (MLRS).



BAe Seawolf—a naval surface-to-air missile system, combat proved in the Falklands Campaign, is designed to provide rapid reaction defence against aircraft and sea skimming missiles.

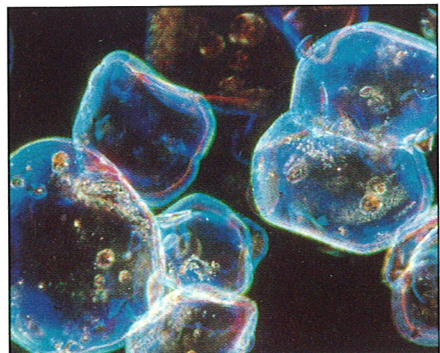


▲ A range of solid propellant charges are produced in lengths and shapes to suit a customer's application, in diameters up to 1500mm. They can be cast, extruded or machined, produced loose or case bonded.



The Javelin Infantry Air Defence Guided Missile closing on and destroying a target aircraft.

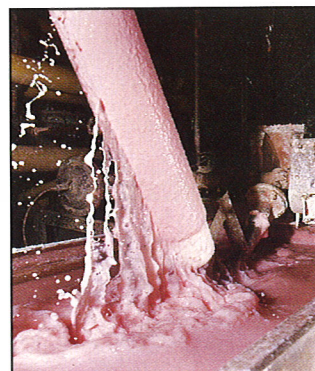




Focal plane screening used to monitor the particle size and distribution in RDX high explosive.



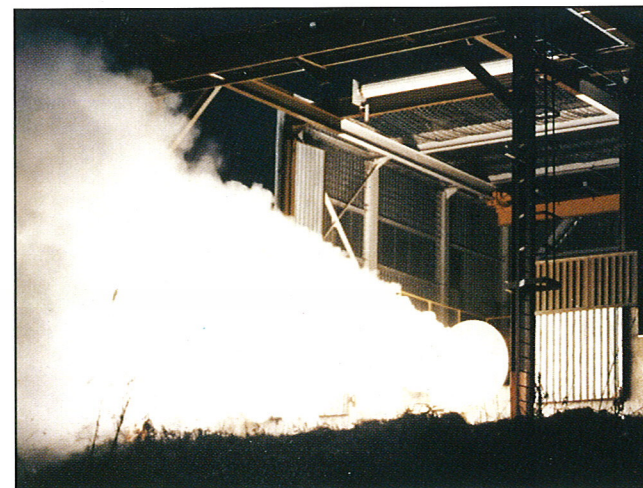
The analysis of high speed detonation photographs to assess the performance and characteristics of explosives.



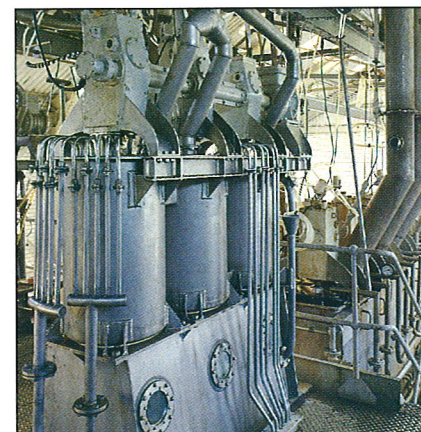
Manufacture of felt preforms at Bishopton used for combustible charge containers which offer improved operational characteristics, reductions in barrel wear and excellent internal ballistic performance.



Launching the tracked Rapiers missile, powered by a Troy dual thrust motor, designed and manufactured by the Division. Motors are designed to operate in variable environmental conditions and have long service life, high reliability, low smoke emission and the option of thrust vector control.



Test firing for evaluation of thrust vector control equipment. Royal Ordnance TVC systems offer a vertical launch capability; high in-flight agility; pitch, yaw and roll control; interception at closer range and an underwater capability.

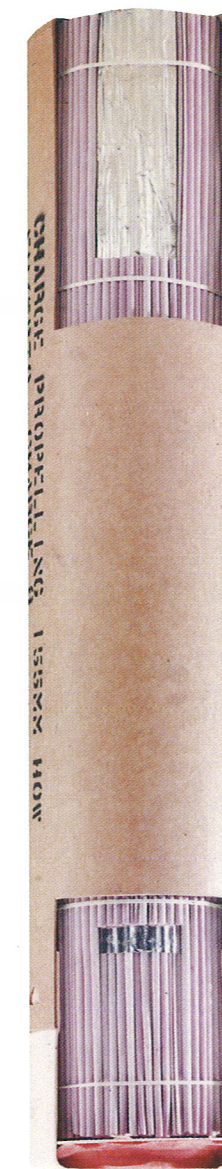


Continuous RDX nitration plant at Bridgwater, Britain's major producer of high explosive for ammunition, warheads and mines, etc. The Division produces explosives of a very high grade for other Divisions within Royal Ordnance and for customers overseas.

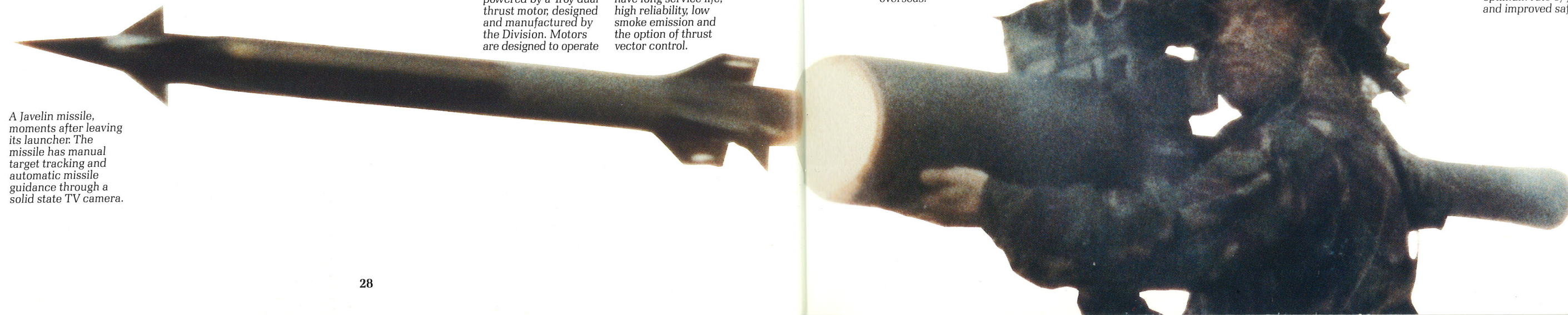
The US Army is at present considering an option to buy RDX, HMX and nitroguanodine from the Division.



Granular gun propellants are produced to specified ballistic performance. Used in widely differing climatic conditions, their high and consistent performance level depends upon precise control in production.



Combustible charge container for 155mm ammunition. It is a rigid cylinder based on a microcellulose composition which is completely consumed on firing. It maximises the range of 155mm artillery and provides optimum rate of fire and improved safety.



A Javelin missile, moments after leaving its launcher. The missile has manual target tracking and automatic missile guidance through a solid state TV camera.



# The Future

At present Royal Ordnance has only a limited share of the vast potential world market. A single percentage increase in this share has rather greater significance in terms of Royal Ordnance's turnover and profit.

There are massive opportunities within the UK itself, and among international markets the US is of obvious importance, particularly in view of signs that the Americans are taking a more flexible approach to their procurement.

Now that Royal Ordnance has emerged fully from beneath the wing of the Ministry of Defence, it is fully equipped to exploit the full range of these new opportunities.

## Key developments

On the one hand it has a unique and integrated capability to design, develop and manufacture systems, subsystems and components of proven excellence and reliability to satisfy its traditional markets.

And on the other, it has the field experience, depth of expertise and R&D resources to collaborate in the development of so-called 'smart' high technology weapons that the more sophisticated military nations, particularly those in NATO, are looking to for their next generation defence systems.

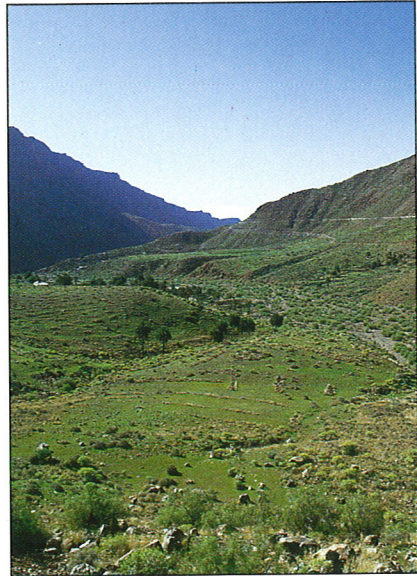
The unit costs of these systems are far greater than those of conventional weapons, and require a much higher level of investment.

The company is already involved in developing a number of these projects.

Some are funded in conjunction with the customer.

Some involve collaborators, both in the UK and overseas. (One advantage of collaboration with international partners is that they provide a bridgehead from which to penetrate local national markets).

And Royal Ordnance has already entered into license agreements with other manufacturers, and is engaged on other projects as prime contractor.



Royal Ordnance has won a pre-eminent place as a supplier of weapons systems to land based forces. These will continue to form the foundation for its future growth.

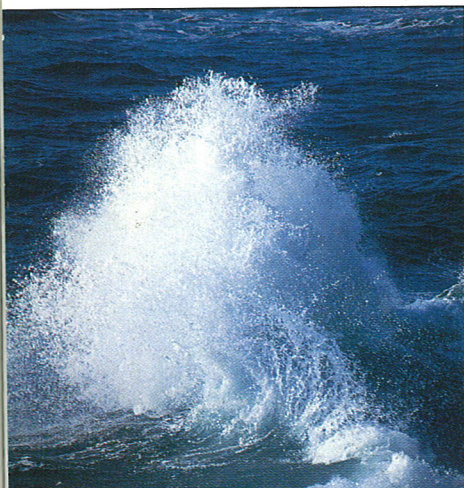
## Geared for growth

The unassailable fact is that Royal Ordnance is by far the largest supplier of ammunition, armour, artillery, missile components and small arms in the UK, and a major supplier of those products to world markets.

Looked at in a more conventional way it is a very large engineering and chemical group operating successfully in a specialised sector of the industry.

Given its highly commercial orientation and its will to go out and win business, the new management has the structure and the business skills to direct Royal Ordnance's recognised resources, expertise and experience to ensure that the company thrives in the new conditions it faces.

Royal Ordnance products are currently being tested and evaluated in over 85 countries around the world. The reorientation of the company has dramatically enhanced the commercial prospects of Royal Ordnance in both the short and the longer term.



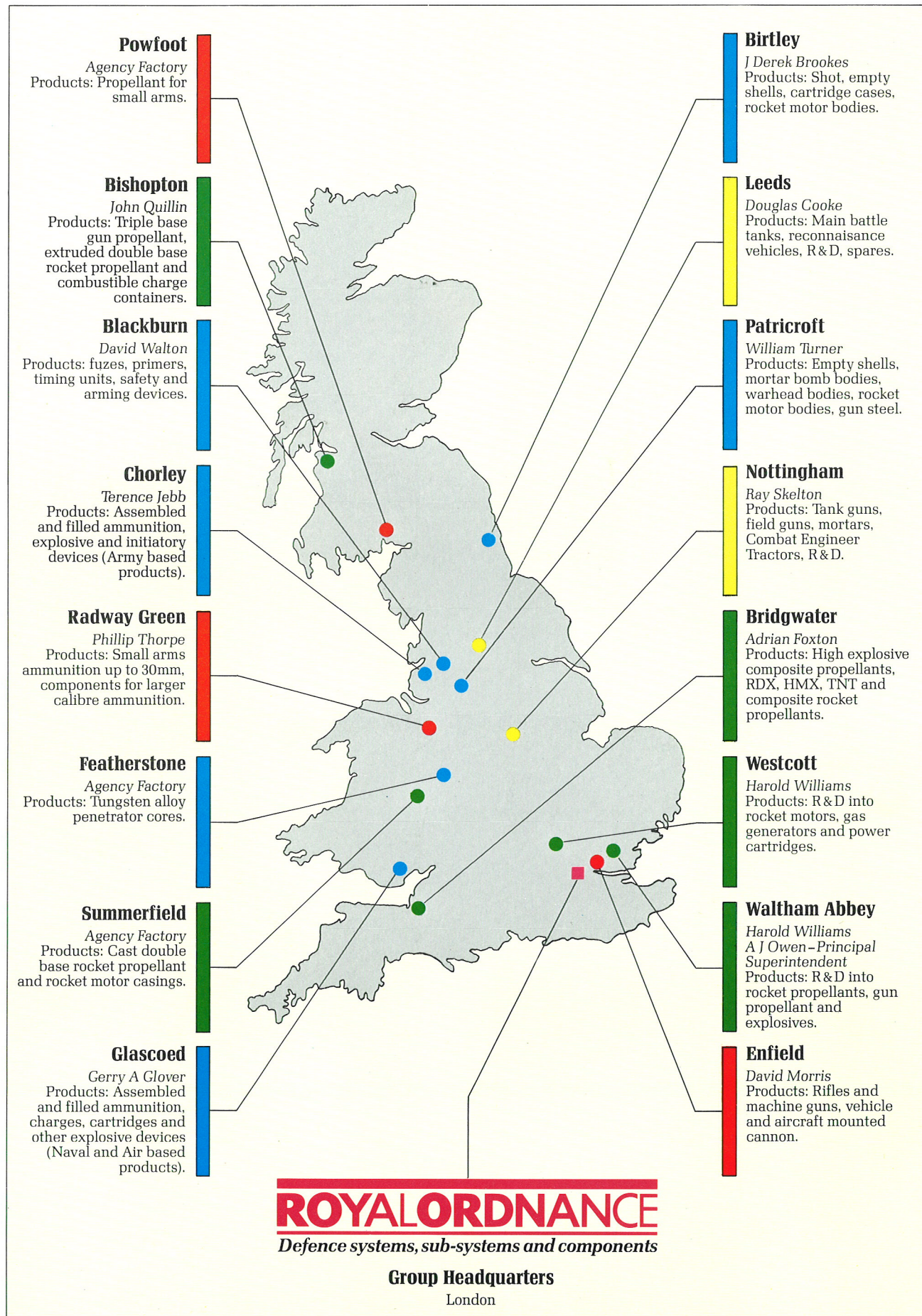
As the Royal Powder Mill, Royal Ordnance helped to defeat the Spanish Armada in 1588. It is currently working on a number of projects to help defend these and other shores.

Royal Ordnance is a primary designer and supplier of air-to-air and air-to-ground weapons. Already heavily involved in developing more sophisticated systems, the company is also examining non-military applications for its technology.



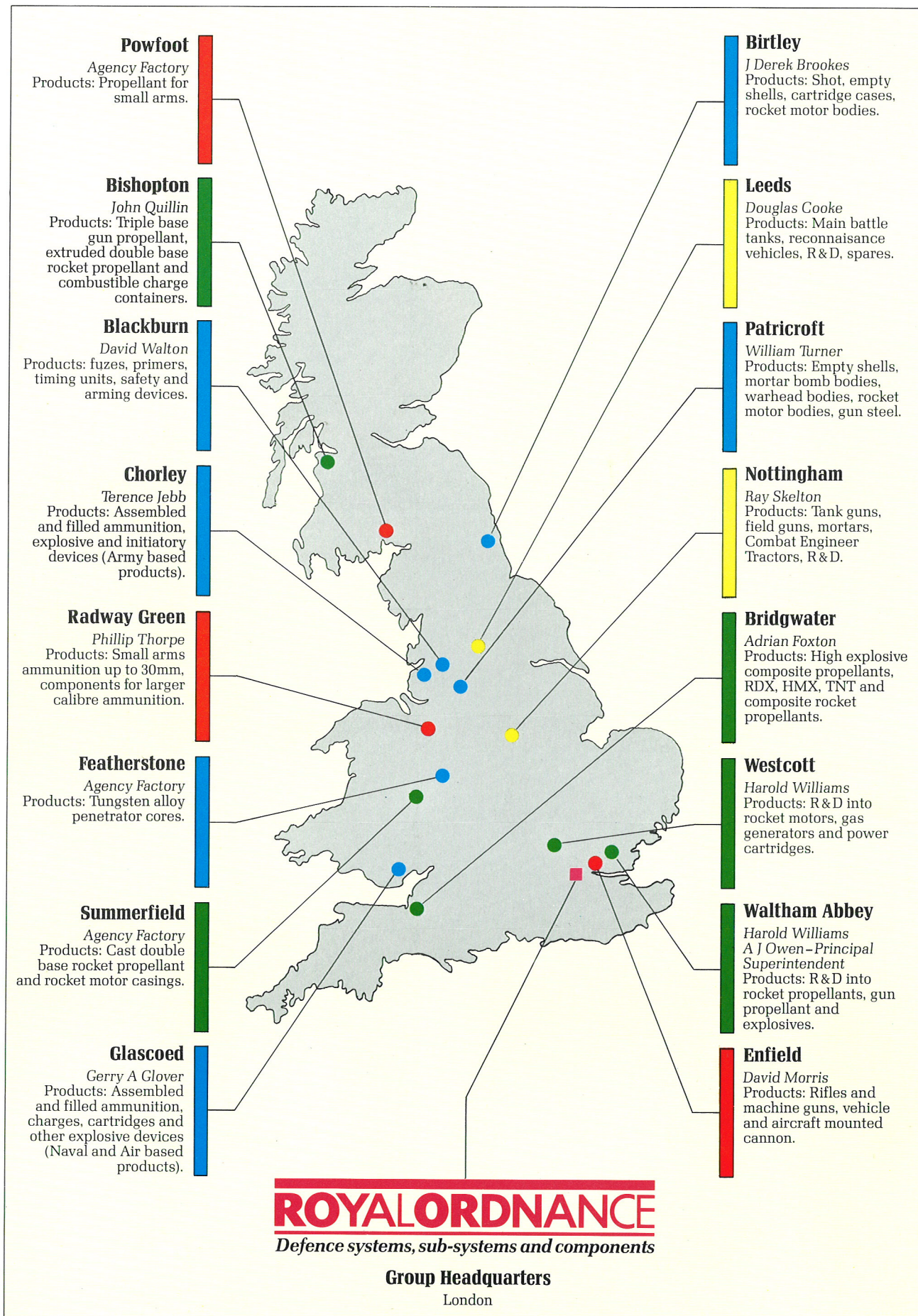


# Manufacturing Locations





# Manufacturing Locations



# Directory

## Group Sales and Marketing

Royal Ordnance  
Griffin House The Strand  
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Telephone 01-930 4355  
Telex 919661

## Ammunition Division

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Chorley  
Lancashire PR7 6AD  
Telephone 02572 6551  
Telex 677495

### Sites at

Birtley  
Blackburn  
Chorley  
Featherstone  
Glascoed  
Patricroft

## Explosives Division

Head Office  
Westcott Aylesbury  
Buckinghamshire HP18 0NZ  
Telephone 0296 651111  
Telex 83144

### Sites at

Bishopton  
Bridgwater  
Summerfield  
Waltham Abbey  
Westcott

## Small Arms Division

Head Office  
Ordnance Road Enfield  
Middlesex EN3 6SU  
Telephone 0992 763333  
Telex 22239

### Sites at

Enfield  
Powfoot  
Radway Green

## Weapons and Fighting Vehicles Division

Head Office  
Manston Lane Crossgates  
Leeds LS15 8ST  
Telephone 0532 608811  
Telex 55360

### Sites at

Leeds  
Nottingham



