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ERDE
PRESS RELEASE

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The Explosives Research and Development Establishment at Waltham Abbey was set up as a centre of chemical research by the Ministry of Supply in 1946. Now in the Procurement Executive, Ministry of Defence, its primary function is to undertake research on, and the development of, explosives, propellants, initiatory and pyrotechnic compositions and related chemicals to meet the present and future requirements of the Services. Also undertaken is research on new composite materials of high strength and the development and application of plastics, rubbers and adhesives for Service use.

To exercise these functions ERDE maintains a staff of scientific, technical and engineering personnel grouped into six branches representing a wide range of disciplines with particular expertise in chemistry, chemical engineering and physics.

Two branches are concerned with propellants - one with propellants based on nitrocellulose, the other with propellants having plastic or rubbery binders. One branch deals with explosives and pyrotechnics, another with general chemistry. The remaining two branches are concerned with polymers and with composite materials. Their work is described in greater detail in the following pages.

Recognition of ERDE's expertise within its field of responsibility is reflected in the many hundreds of requests for help received by its several advisory services over the last few years from both military and civil enquirers.

PROPELLANTS 1 BRANCH

Head of Branch Dr C G Lawson

This Branch is concerned with consultation, research, formulation and development related to all types of propellant based on nitrocellulose. Pilot quantities of propellants for new requirements are made on plant similar to that used for other thermoplastics, and supplied for use in rockets, "power cartridges" and guns to Government Research Establishments or to industry. Manufacture is followed through to the stage where an Ordnance Factory can safely take over. The laboratory back-up facilities cover quality control tests on ingredients and finished propellants, non-destructive testing, ballistic and thermo-chemical measurements. There is full liaison with the Quality Assurance Department in drawing up specifications, and with the Ordnance Board and others on storage and user problems. For example, a lot of recent work has gone to study and reduce the smoke from rockets. Processes have also been developed for non-metallic cartridge cases for guns. Research is continuing on combustion, ballistic and mechanical properties and safety problems of propellants.

PROPELLANTS 2 BRANCH

Head of Branch Mr P R Freeman

"P2 Branch is responsible for the formulation and development of composite propellants required for high performance rockets for both Service and Civil applications. Current research on these materials is mainly devoted towards improving their physical properties and storage characteristics and extending the range of burning rates available. Two main types of composite propellant have emerged from these studies, one with highly elastic or rubbery physical properties, the other exhibiting permanent deformability similar to plasticine or putty. An important function of the Branch is to develop manufacturing processes and techniques suitable for the economic and safe manufacture of these propellants by the Royal Ordnance Factories.

The Branch also provides an advisory service on the use of sealants and adhesives. This service was originally operated for the benefit of designers of Service equipment but it has now been extended and made available to Industry".

EXPLOSIVES BRANCH

Head of Branch Dr C Beck

The Explosives Branch deals primarily with development of sensitive initiator explosives and of secondary high explosives of improved physical properties and explosive performance. Trials are performed to assess sensitiveness and hazards encountered with all explosive materials. The main work of the Branch is carried out by four Sections.

1 Initiating Explosives and Pyrotechnics

The Section has a large fund of experience, knowledge and skill in the techniques of handling these potentially hazardous materials and in developing safe manufacturing methods for full scale production of sensitive compounds such as the azides and styphnates. ERDE patented processes are in use under licence in many Ordnance factories throughout the Commonwealth and in the USA, Sweden and Israel.

2 Safety and Sensitiveness

An important function of this Section is to provide information to almost all users of explosives and propellants on their safety. A major task is the development of standard tests to establish criteria of safety to hazards such as friction, impact, electrostatic spark, etc. A vigorous research programme into the mechanism by which explosives initiate is maintained.

3 New Explosive Composition Development

The development of new composite high explosives of increased power and improved physical properties, is the concern of this Section. The facilities available for the work include equipment for a number of remote processing and testing operations.

4 Detonation and Explosive Performance

The primary function of this Section is to study the release of energy from explosives, to assess the relative power of different explosive compositions and to consider how explosives should be optimised to defeat targets in air and underwater. Facilities are available for measuring underwater shock waves and methods have been developed for simulating sonic bangs from aircraft such as Concorde.

GENERAL CHEMISTRY BRANCH

Head of Branch Dr I Dunstan

The General Chemistry Branch at ERDE offers chemical support services to the rest of the Establishment, to the Royal Ordnance Factories, and to certain firms working on Aerospace Projects. The Branch provides a wide variety of services for consultation, problem solving, and project support in the areas of chemical analysis, physicochemical studies, and preparative chemistry.

One of the chief functions of the Branch is to provide support for all kinds of stability and safe life studies on the explosive and propellant components of weapon systems. Advice is given to designers and manufacturers of weapons on problems arising from the stability and compatibility of explosives and propellants with materials.

The Branch also has a group of chemists particularly concerned with the synthesis, characterisation, and physical and chemical properties of a wide range of ingredients used in explosive, propellant and polymer technology. As well as providing supporting research for manufacturers and users, the group undertakes basic research connected with the kinetics and mechanism of synthesis and decomposition, and is also concerned with techniques for observing and assessing the stability of products exposed to severe environmental conditions.

Synthetic work involves preliminary literature surveys, selection of experimental conditions, and consideration of scale-up factors, particularly potential hazards associated with toxicity and exothermic decomposition. Hazard appraisal is a special feature of the Establishment's work, and chemical manufacturers often consult us on such matters as ignition risks and safety features of chemical processes and plant.

NON-METALLIC MATERIALS BRANCH Polymer Research and Development

Head of Branch Dr B L Hollingsworth

The Branch covers work going on in what is popularly called the rubbers and plastics field. The main emphasis is on the use of such materials in defence equipment, particularly for the Army Department, with some spill-over into civilian technology. For example, contributions have been made to the development of the Dracone flexible barge and in hovercraft.

The work of the Branch can be covered by three underlying themes: the study of the ways in which polymers break down in hostile environments, and the search for ways to prevent this; the measurement of the engineering properties of thermoplastics and the development of test equipment to do this; and the synthesis of new polymers with specific properties aimed at the preparation of new and improved synthetic rubbers and adhesives. In addition, the Branch provides a service in the design, development and production of prototype components in a range of non-metallic materials and an advisory service on the application of polymers. It also supervises long-term environmental testing at the Joint Tropical Research Unit in Queensland, which is a joint project with Australia.

PROCESS RESEARCH BRANCH

Head of Branch Mr H Ziebland

The main function of the Process Research Branch is the study and the development, up to pilot plant scale, of new chemical and mechanical processes for the production of propellant ingredients and composite materials.

In addition, the Branch has the responsibility for the technical administration of the Thermophysical Properties Laboratory which at present is the Reference Laboratory for the British Calibration Service for the measurement of the thermal conductivity of solids, liquids and gases and the holder of the respective National Standards.

The Branch designs, installs and maintains pilot plants for the small-scale production of special chemicals needed for R & D in explosives and propellants. In view of their hazardous nature remotely controlled facilities have been developed for safe processing. Expertise is also maintained in the production of bulk explosives in support of the Royal Ordnance Factories.

In the field of composite materials, patented processes for the grading and alignment of short fibres which have been developed by the Branch are typical examples of "fall out" for wider industrial use and are being exploited commercially through NRDC yielding a profitable return in royalty payments.

The processes make possible the utilisation of a wide variety of short fibre reinforcements in composite materials for defence applications. Civil applications are also encouraged where possible to widen the market and hence reduce costs.

AUTOXIDATION RESEARCH

Head of Group Dr N Uri

This Group concerns itself with two major projects. The first one is concerned with the improvement of the stability of all polymeric materials. It embraces both basic research and development work with a view to increasing our knowledge of the oxidative and light-induced degradation which cause widespread damage to polymeric materials in defence and civilian use.

Amongst the new antioxidants which were discovered by this group is a nickel chelate which is for many important application more efficient than existing commercial products. The second major project concerns the development of new cure catalysts, some of which are also antioxidants. An important achievement is the discovery of a chromium chelate which catalyzes very efficiently the reaction between epoxides and carboxylic acids and is at the same time soluble in most organic media. This could be the basis for some new technological developments in the fields of adhesives and, at some future date, liquid rubber for the production of tyres and other moulded rubber products.

EXHIBITIONS AND DEMONSTRATIONS

South Site

Propellants 1 Branch

Propellant charges and other exhibits illustrating the technology of propellant development for guns and rockets.

Propellants 2 Branch

Items relevant to work on composite propellants, adhesion and rheology.

Explosives Branch

Remote controlled explosives process research facility.

Process Research Branch

Pilot plants for the grading and alignment of short fibres for use in composite materials.

North Site

Non-metallic Materials Branch

Compounding and processing of rubbers and plastics. Mechanical property and ageing tests.

Autoxidation Research Group

New antioxidants and cure catalysts with apparatus for autoxidation studies.

General Chemistry Branch

Advanced instrumental techniques of chemical analysis of application to rocket propellants and to the detection of hidden explosives.