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Financing Industrial Development in the United Kingdom: The National Research Development Corporation, London

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Background and organization

The National Research Development Corporation was established under the Development of Inventions Act of 1948, and amended by Acts passed in 1954, 1958 and 1965 to promote the adoption by industry of new products and processes invented in Government laboratories, universities and elsewhere.

NRDC is an independent public corporation, not a Government department. It does not receive annual grants but is financed with Government loans under the jurisdiction of the Minister of Technology. It is required to balance its accounts in the long term, subject to an overriding consideration of national interest and it therefore has to conduct its activities on a sound commercial basis.

The Development of Inventions Act of 1965 increased the Corporation's borrowing powers from £ 10 million to £ 25 million.¹ Under the same Act, the Minister of Technology, with the consent of the Treasury, was empowered to remit the Corporation's liability to repay any amount borrowed, which in his opinion has been expended exclusively for or in connexion with the development of an invention, and which has been written off by the Corporation; and to give additional assistance in respect of the first eight years' interest on any advance.

The Corporation has authority also to act on behalf, and at the request of, Government departments in undertaking development projects. Such projects are subject to approval by the Minister and the Corporation's expenses would be reimbursed by the appropriate department.

The Corporation is a "Body Corporate" composed of a Chairman, a full-time Managing Director, and up to twelve members, all appointed by the Minister of Technology. Some of the present members are drawn from the executive staff. The Chairman and the other part-time members hold important positions in science, industry and commerce.

There are two executive departments whose subdivisions are conveniently grouped to embrace the entire field of science and technology.

The Applied Sciences Department's groups are Bio-sciences, Industrial Chemistry and Scientific Equipment.

The Engineering Department's groups are Mechanical Engineering, Production Engineering, Electrical Engineering and Electronics, and Computers and Automation.

Service Departments provide financial, patent and legal advice for the executive departments together with library, technical information and public relations services.

There is also a Department of Planning and Policy Co-ordination whose function is self-explanatory.

The Corporation does not manufacture or trade nor does it have its own research or development facilities. Occasionally, however, NRDC will set up subsidiary companies to develop certain inventions.

Functions and activities

The functions of the Corporation as stated in the 1948 Act, are: (a) to seek to license inventions derived principally from Government-financed research and also from other sources; and (b) to make available development finance either to support further development of inventions up to the stage of potential industrial interest or to support joint development projects with industry. *Charts I and II* highlight these functions.

With a few exceptions, NRDC can deal with all types of inventions and projects—computers, instruments, agricultural machinery, plastics, pharmaceuticals, textiles and all aspects of the mechanical and electrical engineering and construction industries.

From 1949 to 1966, about 14 500 inventions were submitted to the Corporation and more than 3 700 were accepted with a view to licensing to industry. About 66 per cent of the assigned inventions derive from Government establishments such as defence research establishments, research establishments controlled by Government departments, the Medical Research Council and the Agricultural Research Council (*Chart II*). The Corporation has a statutory obligation to find an industrial licensee for these; the remaining inventions come from universities, advanced colleges of technology and similar bodies.

Inventions assigned to the Corporation include very few from private individuals and firms, as such submissions are accepted only if they require financing for further technical development considered in the public interest. If a private invention is accepted for development, the Corporation negotiates an agreement with the holder, with the condition that the NRDC must secure a lien on all rights or on a proportion of them sufficient to protect its interest.

The Corporation maintains an active and continuing liaison with all university departments of science, engineering and technology in order to be immediately aware of promising inventions. The patent application is normally made at NRDC expense and the Corporation carries the responsibility and expense for promoting the adoption of the invention by industry.

The work of seeking to interest industry in the assigned inventions has resulted in the signing of about 900 United Kingdom licence agreements, in addition to licence agree-

¹ £ 1 = \$US 2.80.

ments abroad, and ultimately more than 300 products emerged based on patents submitted to the Corporation. The value of the output of these products to date is estimated to be in excess of £ 60 000 000 and the Corporation earned royalties of about £ 2 760 000 including royalties on development projects wholly supported by NRDC.

Chart II shows in more detail the origin of successful inventions which became revenue-earning between 1954 and 1966. The figure illustrates the substantial importance, as a source of new products, of the defence effort during the period 1954-1959 and the subsequent growth in relative importance of civil research. Universities in particular are becoming an increasingly significant source of inventions. It should be remembered that NRDC is only one means by which publicly financed research results are made available to industry, and the Corporation's experience is not necessarily indicative of the relative importance of these different sources of inventions.

Inventions

Each type of invention submitted for consideration requires a different handling procedure:

Inventions from Government sources. Patent rights in these inventions are in general automatically transferred to the Corporation. For non-Government inventions there is no such automatic transfer.

University inventions. The standard agreement provides for a transfer of rights to the Corporation and for a division of revenue between the parties. The rights of the individual inventors in relation to their own employers depend on the terms of their employment. In this connexion, the Corporation must take account of any supporting grants from charitable institutions and the like, and of extramural research contracts from Government departments or industry.

For an invention to be taken up commercially, effective patent protection is important. Premature publication of the invention could preclude valid patent protection. Research workers who intend to publish work which they wish the Corporation to consider for patenting or commercial development must approach the Corporation as far as possible in advance of publication.

In some instances, money is spent to enable the inventor or the inventing team to develop the project from an embryonic stage to a stage where industry could take it over; in others, the Corporation may have this development or part of it done by an industrial firm or by one of the independent institutions which accepts sponsored work.

Private inventions. The Corporation does not act as agent or patent broker on behalf of private inventors who are seeking outlets for fully developed devices or processes; but it assists the development of their inventions if it is considered to be in the public interest. Although the number of inventions accepted from private inventors so far has been small, a substantial proportion of the most significant development projects—for instance, Hovercraft, Perbury gears, fuel cells—originated from this source.

Before accepting a submission, the Corporation assesses its potential technical and commercial merit, using outside advisers where necessary. The agreement between the Corporation and a private inventor normally provides for a sharing of the revenue after any development and patent expenditure has been deducted.

Placing inventions with industry. Returning now to the main intake of inventions from Government and university sources, most of these have reached a stage where it is appropriate to bring them to the notice of industrial firms, while others may be in an embryonic stage and require development. As soon as an invention is judged to be ready for introduction to industry, suitable firms are notified. The Corporation's senior officers have first-hand knowledge

Chart I. NRDC's development and licensing activities from June 1949 to March 1966

Submissions

Public bodies 7 430
Private individuals and firms 7 043
Total 14 473

Assessment

Development support
Proposals accepted for further effort in development and licensing 3 784

Licensing activity

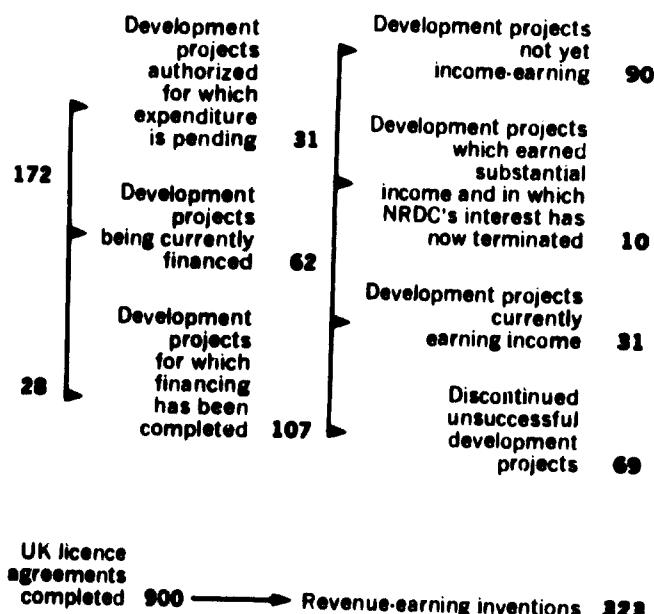
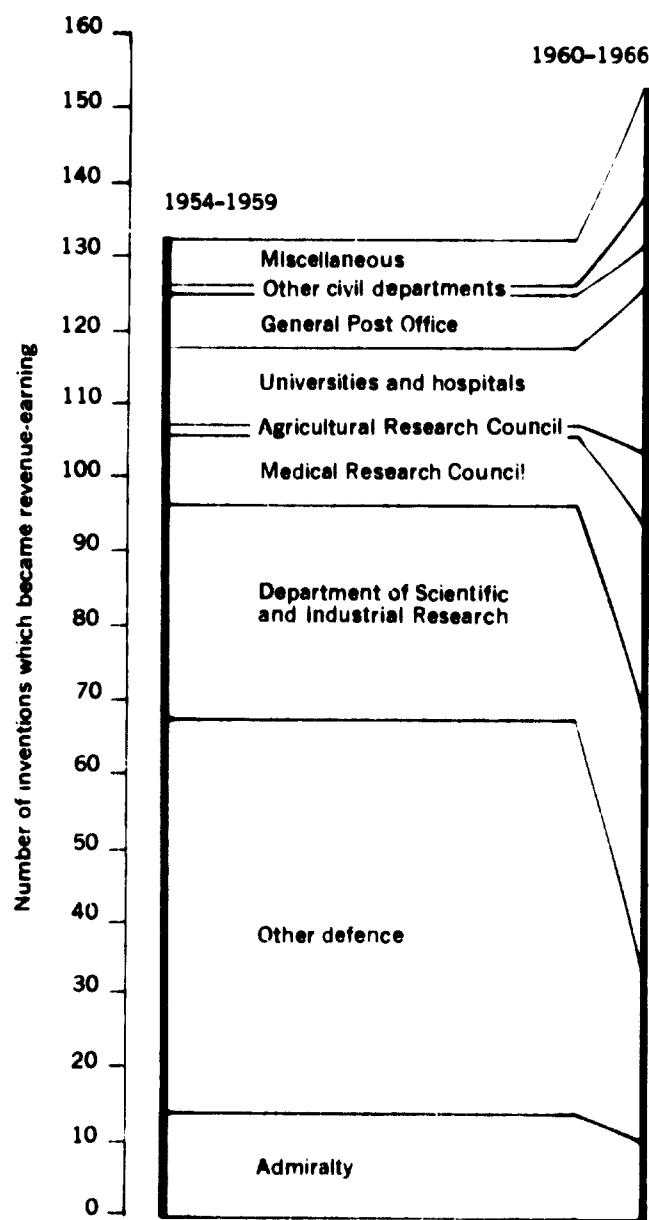


Chart II. Origin of inventions becoming revenue-earning in 1954-1959 and 1960-1966, respectively



	Year ending 30th June			
	1954-1959	1954-1959	1960-1966	1960-1966
	% of total		% of total	
Admiralty.....	15	11	10	7
Other defence.....	53	40	23	15
Dept. of Scientific and Industrial Research.....	27	20	36	24
Medical Research Council....	9	7	23	15
Agricultural Research Council	1	1	10	7
Universities and hospitals....	14	11	25	16
General Post Office.....	7	5	4	3
Other civil departments....	1	1	7	5
Miscellaneous civil sources...	5	4	14	10
Total	132	100	152	100

of firms concerned with that field of specialization and are in a position to contact them. In addition to personal contacts, details are included in a Corporation biannual publication, *Inventions for Industry*, which is sent out to several thousand firms.

When an interested firm is found, the Corporation negotiates a licence with it under the patent rights. Normally this is a non-exclusive agreement providing for a percentage royalty on sales, but each case is governed by its own particular circumstances.

Granting of a sole licence is not precluded. If, for example, a firm can establish that it will have to invest considerable capital to develop or market the invention and that a non-exclusive licence would give it inadequate protection, then a sole right may be granted, in some instances for a limited term of years. The Corporation must also be satisfied that a monopoly is not contrary to the public interest and that the firm has adequate resources to fulfil market demands.

Licences are also granted to firms abroad; in fact over 33 per cent of all exploitation income to date derives from two inventions licensed in the United States of America. NRDC, however, endeavours to protect the export trade of British licensees and will license abroad only if such trade will not be adversely affected. In practice this consideration has not limited significantly the licensing activities of NRDC.

Finance development

Financial support for development projects is another and increasingly important activity of the Corporation. Development on a small or a large scale is always necessary to bring an invention into commercial use. If the commercial merit of the invention is clear at the outset, industrial firms are usually willing and able to complete this development at their own expense, obtaining outside finance if necessary through banks or issuing houses.

If outside financing is not available, the Corporation has the discretion to finance the design and construction of experimental models, the production of pilot-scale quantities of chemicals for clinical or field tests, the construction and trial of several pre-production prototypes, or the adaptation of a known technique in one industry to the needs of another.

In the early 1950's many projects were wholly financed by NRDC, including substantial investment in computers which helped establish the British computer industry. Support for Hovercraft dates back to 1958 (*Figure I*). This approach has an element of risk, however, as illustrated by the substantial number of projects which never yielded significant income and had to be discontinued. Failures result not only from technical difficulties during the development stage, but also from changing market conditions which may occur during the somewhat lengthy development period, making it difficult to license the developed product.

Recently the Corporation has expanded its activities substantially, primarily by increasing support for joint development projects with industrial firms. These projects generally arise from a request for financial assistance in the development of a project originating within the firm. Such requests may arise because the firm wishes to undertake or speed up development and lacks adequate financial resources, or because the firm may wish to reduce the

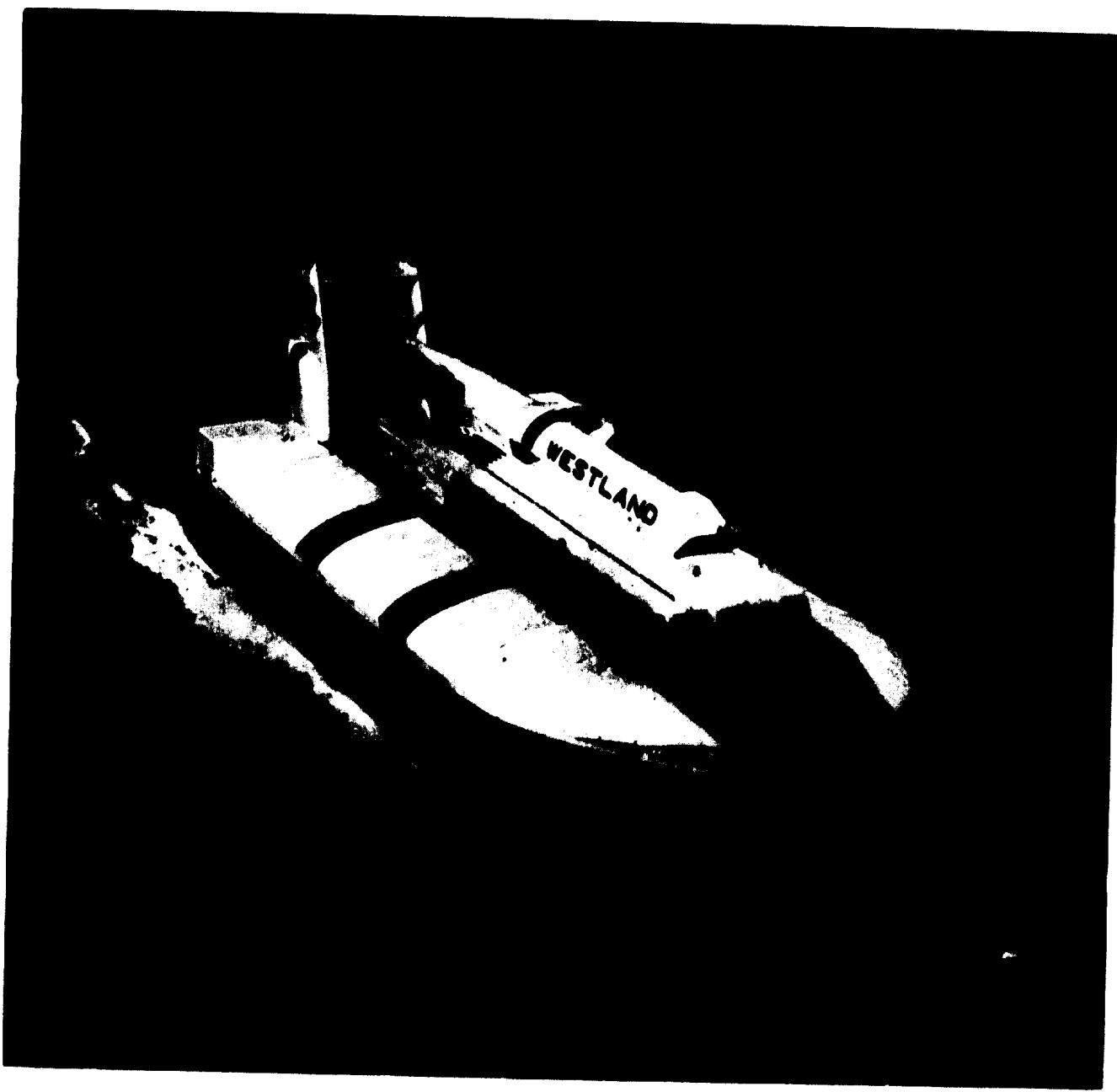


Figure I. The SRN6 Hovercraft, developed by Westland Aircraft Limited, with the support of the National Research Development Corporation, which has to date invested £3 million in Hovercraft.

risk inherent in investing a large percentage of its own resources in any one project. If the innovation is significant and commercial prospects are reasonably good, the Corporation may make available a proportion of the development costs in return for recoveries on subsequent sales of products issuing from the development. The recovery rate is based on best available estimates whereby NRDC would recover its outlay plus a certain premium to compensate for risk.

Joint development projects are likely to show a higher success rate than development situations wholly financed

by the Corporation, for several reasons. First, this eliminates the need to find an interested and able licensee subsequent to development. In addition, proposals originally submitted by a firm are likely to be supported more enthusiastically within the firm, and this enthusiasm is essential for successful development. Third, the fact that the firm puts up 50 per cent of the money encourages a more careful and economic supervision of work.

The increasing importance of joint projects is illustrated by NRDC expenditure figures of £ 3.9 million on current joint projects (March 1966), as compared to actual development expenditure incurred on current non-joint projects of £ 0.9 million. The financial results of this approach are unlikely to show for another five to eight years owing to the considerable time gap between actual development expenditure incurred and significant sales of the final product.

Development projects

The NRDc, the Distillers Co. Ltd. and Elliott-Automation Ltd. are collaborating in a venture designed to obtain optimum output and efficiency in an acetic acid plant, by utilizing computer control (*Figure II*). The over-all cost of the project is expected to be £ 200 000. If successful, the results will be applied to a plant capable of producing 75 000 tons a year. By contributing towards the costs of development of software and instrumentation for this project, the Corporation is essentially encouraging the application of computers in plant and process automation, and also hopes that the control techniques evolved will be applicable to similar oxidation processes.

The Hoverkiln² was developed as a means of firing ceramic ware at the maximum possible speed with extremely high fuel efficiency. Its modern design produces a simple and reliable firing device. The capital cost of a Hoverkiln is less than a tunnel kiln unit for the same output, requires less space and foundation and, because of

its high efficiency, demands a much smaller power supply. The fuel costs for firing earthenware are anticipated at half those of a multipassage kiln and about one-eighth those of a modern gas tunnel or intermittent kiln.

A project now being supported by the Corporation is investigating the process of hot pressing of ceramic materials using temperatures of the order of 600°C to 1 000°C and pressures of the order of 10 000 lb/in.² with a view eventually to commercial exploitation. Up to now small study samples have been used. The project's purpose, however, is to establish whether the process can conveniently be scaled up and, if so, to ascertain which pilot plant design is most suitable.

Publications

Help for the Inventor, a booklet discussing the elementary facts which the beginner inventor should know about

Figure II. Testing the Elliott Arch 9000 computer before dispatch to Distillers Industrial Solvents Division's acetic acid plant at Salt End, Hull. The automation system was developed with the support of NRDc.



patenting along with some of the commercial "facts of life", is available from the Information Officer. The booklet also explains what help the Corporation and other interested bodies can give to the private inventor.

Inventions for Industry, a biannual publication, contains information on the various Corporation activities and provides short descriptions of inventions available under licence; inventions for which the Corporation is seeking industrial partners; and licensed inventions. *Inventions for Industry* is mailed free on request to industrial concerns and to libraries, but not to private individuals, except in special circumstances. Editors of trade journals are invited to reproduce items and apply for photographs.

In addition, an Annual Report is published each summer and is obtainable from Her Majesty's Stationery Office, 49 High Holborn, London, W.C.1, England.

Figure III. *Dracones*, the flexible barges used to transport liquid cargoes over long distances by sea and inland waterways, were conceived by Professor W. R. Hawthorne and his colleagues at the Department of Engineering, Cambridge University, England.

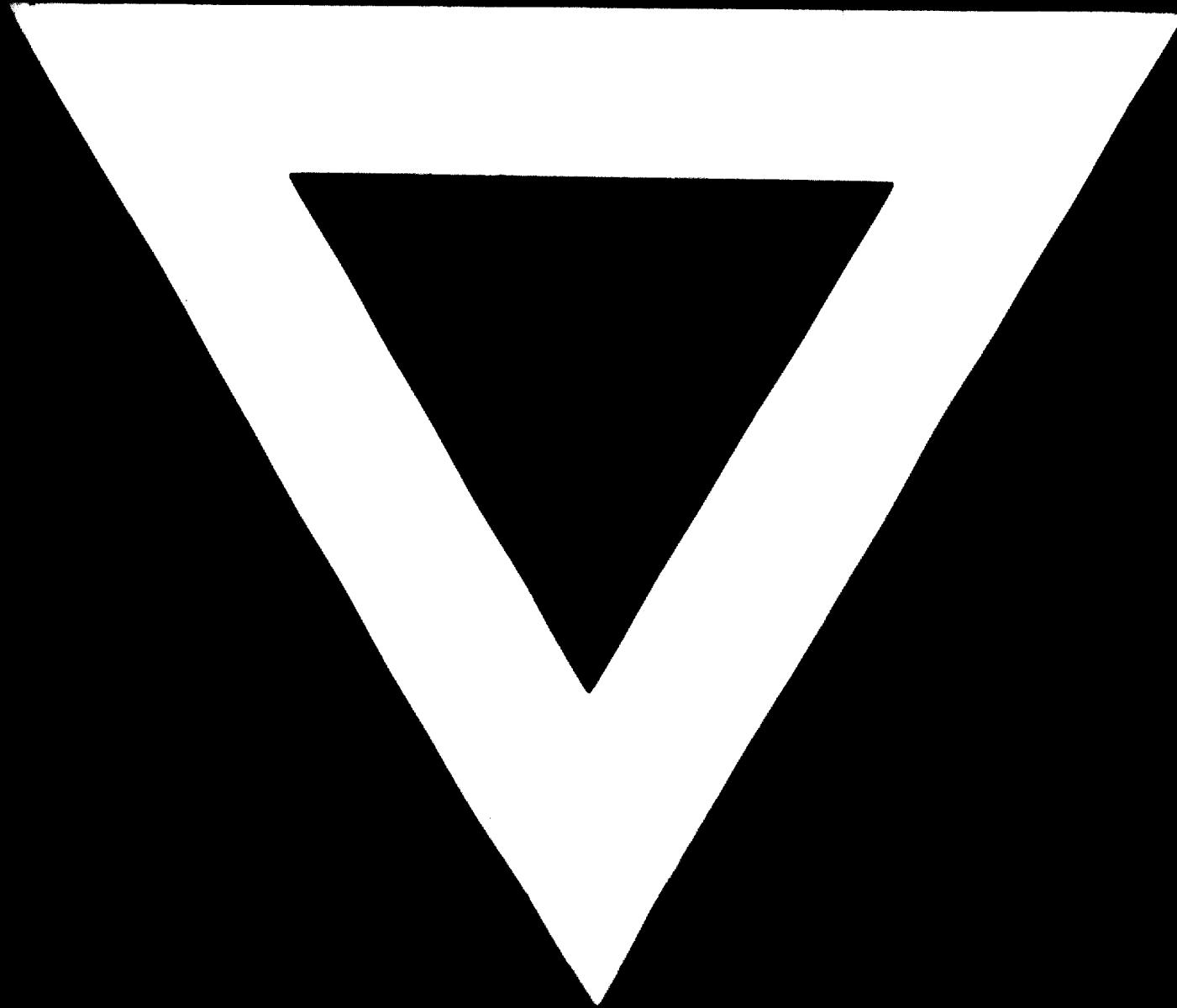
Conclusion

In conclusion, the National Research Development Corporation is designed to form a link between research and industry. It assists the flow of new ideas and techniques to industry and obtains a due return for the money spent in their creation and development. It can promote applied research designed to meet specific needs of industry and assist the advance of technology by investing money in joint research and development ventures with industrial firms. If these are successful, NRDC expects a fair commercial return on its investment.

The Corporation has sponsored development projects in computers, fuel cells, flexible oil barges ("Dracones" - see *Figure III*), pharmaceuticals, cryogenic engineering, diesel engines, variable speed gears, potato harvesters, phototypesetting and many other fields.

Equally important, in the aggregate, are the multitude of small inventions NRDC has supported in the engineering, medical and scientific instruments field. These seldom attract publicity, but by getting them to the stage of commercial viability, the Corporation performs a unique and valuable service to industry.





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