

25th September 1974

U.K. R & D PROGRAMME 1974/75

The planning operations undertaken by the Tobacco Board have implications for the Group R & D programme.

The Study on Security and Economy of Materials does not show up any particular project but suggests a general R & D contribution in utilisation of materials, consideration of alternative materials, improvement of machine efficiencies - all of which are reflected in the general R & D programmes around the Group. A need for technological forecasting is also shown and this could readily be provided by R & D. Here we have experience in forecasting as a necessary part of all important projects but at present we have no identifiable group with this specific responsibility.

The Study on Diversification indicates no specific task for R & D but it is worth noting that Group R & D has working in the tobacco area over 200 technical graduates recruited to a considerable extent from other industries and these would be used occasionally as a source of advice on detailed expertise at virtually no cost.

In addition to R & D work on disease resistance, etc., the Study on Leaf underlines the need for R & D to provide a source of information and guidance in product development information and experimental methodology and a general training function. From this study an R & D project aimed at improving leaf blending techniques would seem to be needed. R & D advice and occasionally experimentation is currently provided on disinfestation, chemical residues, agronomy and leaf processing.

The main impact on the R & D programme, however, as might be expected, comes from the Studies on Market Expansion and on Smoking and Health. The Market Study indicates that R & D should aim generally to provide as much technical understanding and support as possible to achieve the marketing objectives and that this will be related to product attributes and consumer preference. In particular the aim to produce cigarettes with health re-assurance and "normal" taste emerges and one very clear objective "to seek out cigarette characteristics which will significantly affect consumer choice". In the Smoking and Health field the development of new smoking material, new products, modified designs and reconstitution of tobacco, as well as reduction of carbon monoxide, perceived benefits of smoking, special filters, alternatives to nicotine and the study of the susceptible sub-group hypothesis reflect the close association of the current R & D programme with thinking on Smoking and Health over the years.

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Some of the ideas above (e.g. susceptible sub-group) are covered by industry research co-operation (e.g. T.R.C.). Others are covered by Group R & D either than at Southampton (e.g. aeronomy studies and tobacco development) but in fact everything thrown up by the Planning Studies is already in Group R & D programmes - that is not to say that the current emphasis is necessarily correct, and it is intended to raise some of these questions at the next Group research conference. For example, "alternatives to nicotine" is a project at present costing less than £2,000 p.a. and this may be considered inadequate in the light of the Smoking and Health Study and some recent developments. The purpose of this note, however, is to outline the current U.K. R&D programme (other than T.R.C.) for approval by the Tobacco Division Board. A considerable part of U.K. R&D work is concerned with objectives that are already clearly stated and defined by parties paying for it, e.g. P.D.L. work, flavour manufacture, part of machinery development, instrument manufacture. Such work amounts to roughly £600,000 p.a. which is recovered - the remaining R&D work amounts to roughly £2.0 M p.a.

(1)	Smoking Products Research	£525,000
(2)	Life Sciences	£525,000
(3)	New Smoking Materials	£150,000
(4)	Process & Engineering Development	£480,000
(5)	Project PRI-71 and a number of small contract research items etc.	£320,000

(1) SMOKING PRODUCTS RESEARCH

Our research programme is largely aimed at cigarettes which are preferred by smokers either generally or in significant special cases. The part played by the chemical and physical research projects is obvious and has been described on previous occasions. Projects involving human smokers, however, are relatively new and some description may be welcomed.

Under Project WHEAT, about 1,500 smokers have been interviewed and their answers to the McKennell questionnaire examined by factor analysis. There is gratifyingly good agreement between the factors we have isolated and those obtained by McKennell in his studies. Cluster analysis has yielded a picture which, although differing in some points of detail, is again similar to that of McKennell. The Agency report on the preference responses of the 1,500 smokers to four experimental cigarettes, which differ in the level of nicotine in the smoke, will be available in late September. Assuming that the results show a useful pattern it is intended to follow up this work by an examination of the responses to variations

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in "taste" factors. It is possible that market segmentation may be established in terms of motivation profiles. To look further ahead, it may well be possible to examine (under Project OSGOOD, which is discussed later) whether a refined version of the approach can be applied in an overseas market.

During the current year there has been fruitful collaboration with Dr.C.D.Binnie (St. Bartholomew's Hospital) in the study of EEGs (Electroencephelograph "brain-waves") of smokers and non-smokers. The results from an initial survey involving several hundred people will be available in late 1974 and should throw light on the claimed association between EEG response and chronic, ("life-time") smoking. The acute effects of smoking have been examined in a study in G.R & D.C. Southampton using matched groups of smokers and non-smokers. The EEGs were measured by a team from St.Bartholomew's Hospital, with particular attention paid to the Contingent Negative Variation (CNV). The personalities of the subjects were mapped by a consultant psychologist (Mr.M.Oldman) and the way in which the cigarettes were smoked was recorded on our puff-analyser. The computation and detailed analysis of the results will not be available until late 1974, but visual inspection indicates that smoking a cigarette frequently causes a change in the CNV. The experiment involved a certain amount of stress for the subjects, and we know from the puff-analyser that some individuals changed very markedly the way in which they smoked. Since we have chosen not to have access to the personality data (on R&D volunteers), it is difficult to examine the extent to which personality influences smoking behaviour or choice of cigarette and we propose, therefore, in 1974/75 to recruit small "smoking behaviour" panels from outside B.A.T.

The generation of "J-waves" in the brain, might be associated with the elusive factor of "Satisfaction" in smoking and this will be studied more intensively on R&D volunteers.

It is planned to complete Project KEW - an attempt to relate the terms used by consumers in describing perceived differences with the terms in the WOODROSE (BAT internal taste assessment) vocabulary - and to examine the importance of variability in draw resistance as a parameter which influences consumer response.

Work on the control of the puff-by-puff composition of smoke will continue in 1974/75, and consumer response to different smoke "profiles" will be examined. Initially, internal panels will be used, but if encouraging results are obtained, external panels may be required towards the end of 1975.

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A specialised internal panel will continue to be used for the subjective assessment of side-stream smoke, whilst the more traditional WOODHOUSE panels will extend the current work on the link between chemical composition of smoke and aspects of taste and flavour. Significant progress has been made during the current year and further application of oil-water partition, mass spectrometry and, probably, capillary column gas chromatography is planned. This work, together with a renewed attack via amino-acid composition on the recurring problem of blend analysis and a study of the effects of blending on taste factors, will strengthen our input into the technical aspects of product development.

The construction of the Environmental Chamber should be completed in October, and during 1974/75 we will be able to examine how climatic conditions affect taste responses. We know from previous work that climatic conditions affect smoke composition, but there is no information about human response.

Project OSGOOD is a product development project. The initial phase is a detailed study of the technical aspects of the cigarettes available on the Dutch market. We plan to follow this with a research project aimed to test some hypotheses from R & D's smoking product research programme in another market.

Clearly all the above projects depend on continuing our advances in understanding the chemistry and physics of smoke and developing sophisticated techniques aimed towards the design of cigarettes. Specifically combustion studies aimed to control carbon monoxide, the effect of aerosol physics on taste, the contribution of paper formation, the design of filters, the effect of microbiological flora and the effect of processes on the product. Alternative sources of nicotine and alternatives to nicotine will be studied.

(2) LIFE SCIENCES RESEARCH

The Life Sciences Research programme is designed to put B.A.T. in a position to understand the relevance and importance of advances made anywhere in this field and to provide facilities to develop and apply biological tests to our products in order to guide general product development, investment, or the development of specific products.

This programme must give us the facility to respond to the Hunter Committee or any other external constraints on our operations in this respect.

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Until a year ago, the contract research was undertaken at Battelle, Frankfurt. Following the currency revaluation, much of the new extra-mural research has been set up at Life Science Research Limited and Wickham Research Laboratories Limited in the U.K. The cost of the Battelle contract forecast at £360,000 for 1973/74 has been reduced to £200,000 for 1974/75 and costs at Battelle will continue to decrease. The work in progress and envisaged at these centres is outlined below.

BATTELLE: Current studies include both mouse skin painting and inhalation. One rat inhalation project, designed to examine the possibility of enhancing tumour response in the larynx, using a Vitamin A deficient diet, will be completed during the year. In a second inhalation study just started, the effect of smoke from cigarettes containing reconstituted tobacco (PRT) is being compared with an all-tobacco control.

LIFE SCIENCE RESEARCH LTD: The current long-term mouse skin painting experiment, transferred from Battelle, is designed to examine the effect of process variables in the "paper" reconstituted process: it will continue until 1977 although our predictive techniques will probably enable us to form useful judgements in 1975. Allowance is made for a further long-term skin painting experiment. This could be on (a) the effect of nicotine level in tobacco, (b) the best method of utilising stem, or (c) the new style of experiment designed to examine the effect of switching from a standard cigarette to NSM/CYTREL/PRT/BATFLAKE. A short-term sebaceous gland test is being developed and it is expected that this will be used on a routine basis.

WICKHAM RESEARCH LABORATORIES LTD: The current evidence indicates that tobacco smoke condensate is only a weak carcinogen and that the biological activity is largely related to its promotion effect. A six-month promotion study (mouse skin painting) has just started. It is anticipated that a new promotion study will be initiated to examine the effect of foamed BATFLAKE or the effect of tobacco variables on PRT. It may be that we shall propose the establishment of inhalation toxicology facilities at Wickham or at Life Science Ltd.

OTHER EXTRA-MURAL STUDIES (BIBRA): The major study on the toxicity of coumarin in the baboon will continue throughout the Budget year. The results will be published and it is hoped to obtain uniform use or non-use of this additive throughout the tobacco industry. Special toxicity studies on menthol are being undertaken at BIBRA and at Life Science Research Ltd. at the request of Brown & Williamson. The costs will be recovered.

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CONDENSATE PRODUCTION: As an adjunct to the basic clinical painting studies, transferred from Battelle during the year, a condensate production unit has been set up at Southampton. This will continue during the current year and further expansion of facilities and staff is foreseen to meet the increased demand for condensates for the new studies planned.

The new Life Science Laboratory at Southampton will probably be operating in the first part of 1975 but by renting accommodation at Wickham the work has been progressing for some months. The primary objective is to establish quantitative methods of undertaking and assessing inhalation studies. This aim is reinforced by the draft Hunter Committee guidelines for both inhalation and teratological studies. In addition, it is hoped to develop short term in vivo inhalation tests, e.g. tobacco smoke on alveolar macrophages. Other short term assays, such as Nitro Methane Fraction Index test, will continue to be used.

Studies will be undertaken to assess various smoke inhalation systems. The assessment will include (a) the effect of smoke and smoke concentration on the respiratory pattern of various species, (b) the measurement of smoke concentration in terms of gas and particulate phase indices, and (c) the measurement of the dose of smoke reaching target organs in the respiratory system.

It is planned to recruit for the Life Sciences section twelve additional members of staff, including two graduates, a senior animal technician, a number of junior animal technicians and laboratory assistants. The aim remains to have only a research facility at Southampton and to contract out all routine work on animals.

(3) NEW SMOKING MATERIALS

The specific objectives of this work are:

- (a) The development of materials with controlled smoke properties.
- (b) The economic utilisation of waste tobacco.

PRT

Participation in the PRT-71 project will continue through 1974/75. R & D facilities will be used to study the modification of product attributes; in particular, smoke deliveries and subjective properties. Process and product variables will also be monitored.

A study group will be established in Brazil to examine the feasibility of PRT, and experiments will produce and evaluate a suitable product.

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BATFLAKE

Following a comparative evaluation of NSM, CYREL and BATFLAKE in PALL MALL, the consumer trial in Switzerland will be completed.

The development of BATFLAKE will continue with particular reference to physical properties and smoke character.

Process requirements will, as far as possible, be determined to allow provision for BATFLAKE manufacture in a U.K. AST plant.

WASTE TOBACCO UTILISATION

General advice and guidance on waste utilisation will be provided, in particular:

Malaya - R&D recommendation to select the Arengo DIB process has been accepted and advice on the plant and liaison with suppliers will be continued. Develop DIB product with Arengo and evaluate and assist in commissioning.

U.K. - AST plant and process requirements will be determined to enable definitive proposals for the reconstitution of I.E.D. waste to be made. If this is accepted work can then proceed on the construction and commissioning of a plant.

Mexico and Switzerland - Waste tobacco utilisation studies are currently being made.

(4) PROCESS AND ENGINEERING DEVELOPMENT

Primary Manufacture

Work on additive and constituent mass transfer between tobacco types will be continued, and the possible application of the heat treatment of tobacco as a means of modifying the delivery of carbon monoxide in cigarette smoke will be examined.

With successful implementation of the automatic weighing system for tobacco moisture measurements we shall be examining its wide application in factories and leaf plants.

The studies of the air flow through packages of tobacco and the parameters controlling the conditioning of tobacco packages will be completed, together with the current study of moisture variation in the Primary Department of Southampton Branch.

Work on the control of cigarette variability may follow from our current investigation into the between-cigarette variance of blend and smoke chemistry results and the results from the P.D.L. exercise on current U.K. manufacture may be useful in providing standards of comparison. The use of the Xray method for establishing the CNS and/or reconstituted tobacco proportion in cigarettes has not yet been fully developed and further work is necessary to devise a method of routine operation.

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Background work on the conditions which affect the rolling power of cut tobacco was recently completed and this will be continued.

Secondary Manufacture

Our contract with AMF Sasib is likely to continue well into the new financial year although we could find it terminating on a basis of, say, 3 months' notice. The investigational work with data logging of cigarette machine performance and its contribution to machine fault diagnosis is considered a fruitful area and it is proposed to continue this. We may use the experience with the ARENCO DOQ mentholating unit to examine the possibility of using this technique for flavouring cigarettes.

Molins have suggested that we co-operate with them in devising a common language and procedure for fault logging as an aid to efficiency improvement.

It is expected that we shall continue to be involved in the performance of Cigarette Weight Controls and the associated systems. In particular, we shall be evaluating the modified Measurex Unit. We are committed to the next phase of Project LEATHERHEAD and it is expected that this will involve a substantial effort in the early part of the new financial year. At present we do not know the marketing reaction to the printed polypropylene film Soft Cup Pack. Should it be favourable then we may be involved in the associated development leading to a production capability.

At the beginning of the financial year the first of the B.A.T. Cigarette Mouthpiece Inserters built under licence by Dickinson will be on trial in Group R & D Centre prior to shipment to Canada.

In support of the STANSTED programme we shall also be conducting trials to establish the optimum condition for efficient manufacture and packing of cigarettes and filters.

It is proposed to restart our work on the interaction of materials, adhesive and machine if active co-operation on the part of Molins can be developed.

Filter Machinery Development

During the next financial year it is expected to start work on filter machinery development for the diffusion filter. The study of the parameters affecting filter firmness will be continued.

The transfer of the further machinery development for the HEX filter to Molins may be achieved and the completion of the fibrillated polypropylene film filter is planned.

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Instrument Development

The present commitments for control systems for the I.T.M. (Imperial Tobacco Machinery) dryers and the completion of the development for the weigh conveyors so that these can be transferred to the Instrument Manufacture Section will occupy much of the early part of the new financial year. However, it is intended to examine other areas where instruments and their associated controls might be used in production process.

(5) PRT-71 AND OTHER CONTRACTS

PRT-71 covers work in Canada on leaf growing and curing, in Bristol, in Southampton, in contract biological research laboratories and in Wiggins Teape where the semi-commercial plant is operated under contract to B.A.T. We should be able to reach some conclusions in 1975 on properties of the product range - both acceptance and biological, on production costs, on plant and process design factors and specifically on possible use initially in Brazil and U.S.A. The next nine months should see the maximum rate of expenditure reached and passed. The main development part of this project should be completed in 1975 and the plant will then only be required for work specific to the design of a large scale process. The main question to be answered in 1974/75 is thus the future use of the technology developed in this project.

Work on alternatives to nicotine should probably be expanded. This has so far been limited to a number of small university contracts. It is worth considering whether a reasonably substantial long term project should be initiated. This could lead either to ethical drug administration by smoking or possibly to modified general smoking products for the 1980's. A programme with an initial commitment of about £10,000 for a feasibility study followed by a phased programme starting at about £15,000 p.a. is envisaged.

Another area worth exploring is the possibility of producing very high priced organic chemicals by the extraction of waste tobacco - or of tobacco before use in cigarettes. There is, for example, a requirement for solanesol which is present in tobacco at about 1% and which would probably sell upwards of \$100/lb. This area might be covered by the Brazilian research staff, but again an initial feasibility study by a contract research organisation could be worth while.

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