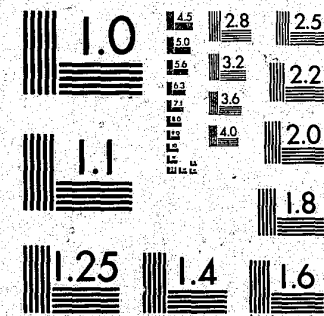


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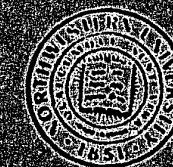
GRADUATE SCHOOL OF MANAGEMENT  
NORTHWESTERN UNIVERSITY  
Evanston, Illinois 60201

Report to  
National Institute for Law Enforcement  
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Studies and Action Programs on the  
Law Enforcement Equipment R&D System:  
Evaluative Study of the Equipment Systems Improvement Program  
NILECJ Grant No. 74-NI-99-0004-G

Michael Radnor  
Principal Investigator  
January 31, 1975

- Volume I Introduction and Overview
- Volume II The Research Program
- Volume III Recommendations for Further NILECJ Research
- Volume IV Appendices



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We would like to thank the many people and agencies who cooperated with us during the course of our study. These included the many personnel from Law Enforcement agencies, Producer companies, and specialists located throughout the country and abroad. Our work was greatly aided by the efforts of members of the ESIP advisory board ( David Anderson and Keith Bergstrom ) and NILECJ personnel ( Goeffrey Alprin, Michael Beller, Joseph Kochanski, Richard Linster and Lester Shubin ) who provided useful inputs to our study.

Particular thanks are in order to Mr. George Shollenberger, our most recent NILECJ project monitor, for the very helpful and important guidance he has provided to our work, and the many valuable and insightful recommendations he made.

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## Abstract

The substantive discussion in this report is presented in three volumes. Volume I is an executive overview of the whole report. It contains an evaluation of the NILECJ ESIP program in the light of our research carried out under NILECJ grant 74-NI-99-0004-G. The ESIP program is criticized for its lack of policy direction and suggestions are made for redirection. The point is made that NILECJ must recognize that an equipment and systems improvement program involves management of the implementation, diffusion and dissemination as well as the innovation aspects of the total R&D system. The critical importance of market and user behavior and capability as policy targets is highlighted. An overview is given on the research to date. This was based on analyses of key issues (The Producer R,D&E Process; Law Enforcement Markets; Information Transfer and Dissemination; Need Identification; Cooperation Between Users; Funding and Budgeting; The Equipment Acquisition Process; Installation Utilization, Maintenance, and Assessment). In addition analyses are presented of ten selected law enforcement products (Body armor, Holster utility belts, Low-light photography and surveillance equipment, Nonlethal weapons, Portable transceivers, Vehicle locators, Voice identification, Weapons detection, Building design for courts and prisons, Court recording systems), and comparative analyses of producers, users, distributors and other agencies. Suggestions are made for further work of both research and action orientations.

Volume II is a report of the findings of the research that has been completed under the NILECJ grant in 1974.

Volume III describes new work that NILECJ should undertake. Further analysis of the issues identified in the Northwestern 1974 study is suggested. Two issues (user cooperation and information transfer) were selected as needing further intensive research efforts. Five new issues (developing user in-house capabilities, problems and opportunities with small producers, strategies for federal development and marketing programs, design of a regional model equipment center and international cooperation) are explicated. Suggestions are made to increase the number of products studied and expand the sample of users. Several action programs are proposed including the design and testing of training programs, the conducting of a field experiment on the effect of supplying good product information to law enforcement users, and the design of a model regional equipment and expert center.

Volume IV contains the appendices.

## Foreword

The improvement of law enforcement must come from an improvement in law enforcement systems. Such systems require proper availability and utilization of personnel, facilities and equipment. Equipment is but one part of an effective law enforcement process, and on an expenditure basis only a relatively small part. But it is a very necessary component. It is vital that law enforcement agencies have access to satisfactory equipment and be capable of using it to the maximum benefit. While it is true that present day law enforcement is and is likely to remain labor intensive, there may well be missed opportunities to increase personnel effectiveness and productivity through better equipment utilization.

But there are significant barriers to such a path of improvement. The right products are not always available at the right price or at any price. The supply side of the system (manufacturers, distributors, service organizations) are often little motivated to invest and innovate in the law enforcement equipment business. In turn law enforcement agencies generally lack the capabilities and incentives to identify proper equipment opportunities, to effectively test, evaluate, select and use equipment and are constrained by low equipment budgets. There are enormous weaknesses at every stage of the overall equipment system, from R&D through supply through acquisition and use, on both the supply (producer) and user sides.

Ways must be found to improve the total operation of this system. Federal government has a role to play, and must recognize that its responsibilities go beyond the usual perspectives of supplying additional fiscal resources and/or creating new R&D outputs that are pushed out to potential producers and users.

Not that the fiscal assistance role is unimportant. At present, only around ten per cent of the budgets of many law enforcement agencies is channelled into equipment acquisition - with most of this going to purchase of automobiles and communications equipment. This leaves very little (and hence a generally unattractive scattered market) for the rest of the equipment sector. Additional federal funds targetted to these other areas could have a major impact. But this should not be the only perspective. Law enforcement agencies should be helped to recognize that there are potentially significant benefits to be gained from using a larger proportion of their budgets on equipment and facilities that upgrade and extend their personnel

utilization. They need to be helped to make a stronger case to their local funding sources (cities, states etc.) for budget increases predicated on improved effectiveness and productivity derivable from proper investment in equipment having multi-year life. To give this help requires not only the provision of better products but, perhaps more important, improved information and training.

Further, if a large proportion of what agencies currently spend on equipment is going into the two major sectors of transportation and communications what can federal government do to improve the productivity of the funds channelled to these areas? Simple answers of generating more competition and hence possible lower prices, while not to be ignored, will not suffice. Action is needed on the producer side to promote product improvement and cost reduction. But it is also required on the user side to promote better in-house capabilities for systems selection, design and maintenance; and so to promote relations with producers that forces more effective producer behavior and also permits a more effective division of labor. Agencies today are paying for their own lack of in-house capabilities through higher prices - often traceable to their own decision making ineptitude and the high producer cost of doing business with customers who need help in design, adaptation, service and maintenance and who buy in inefficient and diffused ways.

There is need for new equipment not currently available. It is far from clear that this is the major gap in the system. Users don't and can't properly use what is in place now. Even given the need for innovation (rather than diffusion) it is not clear that federal government can or should take upon itself the major supply role in this respect. Ways must be sought to stimulate the appropriate areas of the private sector to create and commercialize such innovation. The federal role can then concentrate on filling gaps and expanding capacities that cannot be feasibly taken up by industry and other institutions. Even here care must be taken to work cooperatively and in harmony with proper established institutions to avoid creation of federal products, whether hardware or service, that immediately encounter enormous commercialization and legitimacy barriers.

It becomes clear that for a federal agency to hope to have a meaningful and sustained impact it must develop policies that deal with and nest into the total innovation, production, diffusion and utilization system. As the agency with such responsibility in the law enforcement field NILECJ must have available to it the knowledge of how this system operates, what are the

key issues to be dealt with, and what are the policy options available to it so as to effectively contribute at any required system level of stage. Further, NILECJ itself must have the in-house capability that permits it to benefit effectively from and to implement the policy implications of such knowledge. An equipment program that spans the innovation to commercialization to use spectrum must therefore be recognized as being much more than a purely technical program. There is an ever present danger that technical people will tend to define the total system issues as being largely technical in nature. NILECJ's in-house group must have broader vision - either in terms of its own personnel or from the outside help it solicits.

This study has been devoted to providing that required knowledge. It is a research project designed to uncover the salient facts, provide decision roadmaps and policy options based on these facts as identified in the field and go on to indicate additional areas in which new knowledge is required. Such a research program can contribute to the development and can help support an effective NILECJ policy planning, implementation, and evaluation program. It must be seen as an on-going supplementary activity. We hope that this study can represent a significant first step in this direction.

Michael Radnor  
Principal Investigator  
January 1975

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## I. INTRODUCTION AND OVERVIEW

### 1.1 E.S.I.P. Evaluation

Improvement of law enforcement effectiveness is a major national goal, and proper utilization of effectively developed equipment can be an important component of efficient law enforcement systems. The generation, diffusion, and implementation of improvements in equipment systems and major facilities is a central problem to all forms of local and federal government. It is becoming the focus of efforts of researchers because of the significance of efficient R&D systems in generating required improvement. These conditions are of particular concern in law enforcement.

We have been researching this process of equipment R&D under Grant 74-NI-99-004-G from NILECJ for more than a year. Our first priority has been to systematically describe the present R&D system for law enforcement and identify potential policy options. The first analysis of results from this study also permits us to examine how well NILECJ programs in the (ATD) Advanced Technology Division, are meeting the immediate and long run needs of the law enforcement system.

The preliminary findings from our study have led us to question whether the Equipment Systems Improvement Program that NILECJ has been pursuing for some years, and which is now part of ATD, is properly focussed on those key issues requiring solution, and whether the present efforts are in fact likely to lead to the needed improvement in law enforcement. We do not, at this point, believe that continued investment of resources in current programs, in their present forms, will result in significant national benefits either in the long or short run. It is our present evaluation that the program has suffered from a lack of policy direction; policies that should have been based on a systematic appraisal of the real world situation and of the key issues confronting the main elements of the producer to user R&D system for law enforcement equipment. We believe that the type of research which NILECJ commissioned our team at Northwestern to undertake does represent an important first step in developing a base of knowledge and understanding of the law enforcement equipment R&D system. This system spans the R&D source to manufacturer to law enforcement agency spectrum. Such understanding is necessary to set proper policies in this arena and provide criteria and guidelines for effective program evaluation and monitoring. In

this report we will set out some of the details of our research to date and its implications, and propose areas for further study.

Detailed information will be provided below but it will be helpful to review some of the critical issues confronting a national equipment systems improvement program and how these relate to NILECJ's ESIP effort.

The policy issues to be discussed revolve around one central theme -- the effective execution of a proper and most productive (cost/effective) role for central government in law enforcement technology, given the state we can observe today.

Two essentially counterpointed policy strategies can be compared. In one, central government can be seen as having the role of identifying what it believes to be specific product information and systems gaps that law enforcement agencies have (whether they are aware of them or not). It then acts to fill these gaps by creating the "needed" products, information and systems and goes on to disseminate these to the appropriate product and systems producers and users. In the second strategy government acts to improve user recognition of their own needs (through information flow, training, etc.) and their capability and motivation to select, acquire and use appropriate technology as relevant to their needs. At the same time it acts to stimulate producer recognition of the market opportunities in filling user requirements, and assists such producers by acting to increase their incentives (risk reduction) and capability to respond to such emergent opportunities. These have sometimes been described as the technology "push" versus "pull" strategies. The meeting place of both strategies is the "market place". Any process of policy formation in our economy must take explicit account of the nature (actual and potential) of the markets that do and will face product producers and in which user agencies will have to acquire their technologies.

In practice we are rarely able to rely on either one or the other of these "pure" strategies. Some combination is usually required and this seems appropriate given the state of present day law enforcement. But there are critical problems of implementation to be overcome. To the extent that a push strategy is used care must be taken to ensure that what is provided is that which users really need and can be persuaded to use, further, that producers are really willing and able to manufacture the products at appropriate quantity, quality and price levels. And, finally, that government does not alienate the partici-

pants to the system in the process. The pull strategy is slow and diffuse, and depends on central government having a finely tuned understanding of, patience with, and belief in a wide spectrum of users and potential and actual producers.

As we view the ESIP effort to date the indications are that the program is being pursued with insufficient recognition of and response to the issues to be dealt with in either of the above strategies with no proper consideration of the appropriate balance required between the two. At best we see ESIP as an ad hoc temporary arrangement pending formulation of goals and programs that have been set in the light of a clear understanding of the needs and opportunities of the field and the constraints of national policies and programs. A long and near term strategy must be developed if the current eight million dollar budget is to be used to its fullest impact. To do this NILECJ must engage in well directed programs of policy planning and research. Without this focus the expenditure of even eight million dollars must be viewed as excessive and even wasteful. With properly understood and formulated goals, justification for even higher expenditures may well be establishable and sustainable.

We are not, by these remarks, necessarily implying criticism of the main contractual participants of ESIP; Aerospace Corporation, Mitre Corporation and National Bureau of Standards. These all have the reputation of being good organizations capable of doing very good work. The issue is are (or were) they working on the correct tasks, or the appropriate aspects of the tasks that need doing, and whether there are other critical issues not receiving attention from anyone.

Our research is indicating that there are critical problems in the market place -- in terms of patterns of incentives and risk, and in structure. There are critical gaps in the capabilities of and technical assistance available to user agencies; in the systems for disseminating information on equipment, systems and utilization; in the access to and utilization of funding; and so on. For many users the issue is one of catch up to a much larger extent than it is one of there not being available the equipment that they want -- and are capable of acquiring and using -- if it only existed. For many the problem then is one of diffusion rather than innovation; not a lack of products so much as a need to create user demand and so create markets. Frequently it is not in the area of a lack of hardware but a lack of the development of functional operating systems, utilizing the available law enforcement equipment. To the extent that there is

a major problem of a lack of established standards for law enforcement products that agencies do acquire, and there certainly does appear to be such a gap, then the issue to be dealt with is what kind of standards do user agencies really need, which they would be capable of using effectively and which they could accept as legitimate.

In the context of these central questions we either see little meaningful attention from ESIP, overemphasized concentration on new hardware development (with insufficient concern for commercialization issues) and the development of standards that are not appropriate to current user needs and which are not developing the necessary legitimacy. Nor in all this current effort do we see an explicit consideration of what can and should be done by central government, what can be done by local government and what can best be done by stimulating and reinforcing the private enterprise sector. Also, research for hardware needs to be carried out much more in conjunction with mission requirements. How can law enforcement agencies operate effectively -- in a total systems approach? Law enforcement agencies purchase equipment as systems for use. In fact, it may be much easier for them to fund programs than equipment. Further research efforts, whether these are hardware development by ESIP or product-oriented studies of the type we are doing, should be carried out with an explicit recognition of the systems perspective.

This brings us again to the whole question of the markets for law enforcement equipment that face many producers. There are some negative aspects. We observe that firms frequently express misgivings concerning the markets, despite some attraction that a number of them do find in the field. Some comment on the difficulties of doing business with a scattered diverse market, problems of competitive bidding, etc., although these perceptions tend to vary somewhat by product and firm type. Very few feel that they could be in the market if they had to depend entirely on the law enforcement sector. Some of the firms do seem to be doing a good, committed job in law enforcement but they often complain of getting little reinforcement or notice. This seems to be especially the case for the very small companies. These very small companies may be playing an important role in the law enforcement equipment market in both high and low technology areas. This represents an important topic that requires further research. A balanced program might well consider the opportunities of helping such small organizations and benefiting from their potential contribu-

tion, as well as working through the large high technology firms. Certainly it will be necessary to work with these latter companies and we are not suggesting that NILECJ totally abandon the development route presently being used through organizations such as Aerospace Corporation. But this route still leaves unanswered the issue of how commercialization will take place of the products so developed -- the same gap that has existed from the beginning of the ESIP program and which seems no nearer to being closed.

One example of a policy option that might be explored in this marketing area, as it relates to small firms, is the linking of such companies as sub-contractors and licensees to large prime development contractors. Implicit here would be an attempt by NILECJ to answer the question of how and where can government work in cooperation with the private sector, to help it do what it can do best. A specific problem area that appears amenable to government intervention in this way has to do with the purchasing/selling process to be found in law enforcement. The problems result from the bidding process that is typically used and also from the difficulty that producers, particularly the small ones, find in having to work with a very large number of small, low budget and geographically dispersed law enforcement agencies. There may be a useful role for central regional government in product acquisition, in the stimulation of joint, cooperative and larger scale purchasing arrangements, testing programs, etc. We have encountered a number of tentative programs in this direction and there may well be opportunities to expand such cooperative efforts -- possibly utilizing an LEAA region and a central (regional) producers' advisory service, in a pilot program. A benefit for the small producer would be to make entry easier. Complementary programs might involve providing federal R&D funds to smaller producers possibly, as we noted, by channelling prototype sub-contracts to such firms through the large manufacturers. It is our firm conviction that if law enforcement agencies are to be upgraded this will be achievable, in the short run, only partially through direct personnel related efforts. Intermediaries will be needed and good entrepreneurial and technical small companies may have a significant role to play.

The central question for NILECJ remains one of how the relatively modest eight million dollar program, given the enormous size of the law enforcement world, can be leveraged to achieve some useful lasting impact. This, rather than being poured into areas that may superficially appear to be productive ("we have caused

this or that new product to be invented") but which are not dealing with the real needs. A critical issue then becomes the NILECJ capability in Washington, D. C. Is the group strong enough, both technically and manpower wise, to set policy for, direct and monitor a major technological upgrading program? Does the NILECJ/ESIP team have the personnel with, for example, the necessary marketing, market research or legal training to deal with the inherent complex system issues? Even if the ESIP effort were restricted to giving emphasis to product development through the high technology companies the question of the NILECJ capability would remain -- if the Institute were not to fall captive to such contractors. Agencies such as NASA have long understood the need for strong in-house technical capabilities if they are to successfully monitor high technology contracts. The Institute might well consider whether part of its available resources should be invested in building up its own internal capabilities. It can be strongly argued that the Institute itself should be doing the definition work that it has been asking Aerospace Corporation to supply. ESIP has not been building up the perspectives and policy options that it must have. In contrast there is some evidence that it has not been as creative as it might have been in working with agencies and other groups with whom it might usefully try to develop cooperation (e.g., IACP).

A longer run policy issue is the question of whether NILECJ should be working towards the establishment of a national law enforcement technology laboratory along lines similar to that found in Britain and Japan, coupled with a decentralized assistance program for users and producers. At the present time NILECJ is using Aerospace Corporation as a substitute. This could lead to a conclusion that the present ESIP set up is a temporary and partial solution for the lack of a national laboratory (or laboratories) and the lack of a strong policy directing NILECJ capability. Such a capability could be complemented by university programs around the country helping in both problem identification, generation of options and design alternatives and in implementation -- including the carrying out of experimental and model programs. It will also be vital to have the meaningful involvement of law enforcement agencies.\* Some of the possible policy options that might be a basis for such an effort are shown in Figure 1. It appears to us that NILECJ has been underestimating the time horizon required for an improvement program while backing in to a much bigger issue than it seems to have realized, by its behavior in ESIP. Crime research must grow and in ESIP, NILECJ has "a whale by the tail".

\* In a much more effective manner than that pursued on the MITRE program which used a combination of mail questionnaires and some field located OR personnel - both inappropriate to the issues.



Figure 1. EXAMPLES OF POLICY OPTIONS FOR MODIFIED ESIP PROGRAM

Support On-Going Research

1. NILECJ should support research on the key issues identified. This research could be carried out in-house at NILECJ or by universities, non-profits, etc.  
Does NILECJ have the capability?  
Are there the necessary skilled, experienced, and motivated universities available?  
Could L.E. agencies be co-opted into such research programs?  
The research should be continuing -- not hit-and-run, random studies.
2. Support programs to develop hardware which should be accompanied by systems and organizational studies. Specific attention to be paid as to whether the programs are properly targetted, implementable, etc.
3. Create guidelines for Federal role in product development and commercial action.

Dissemination of Information

1. Create a national Clearinghouse for Information.  
Who should do this? How should it operate?  
Could NILECJ's Technology Transfer department perform this role?
2. Mechanisms to improve information transfer between U.S. and other nations should be set up. Co-locate people in NILECJ equivalents in each country.

Develop New Institutions

1. Set up Regional Equipment Center where L.E. agencies can borrow equipment and experts.
2. Set up national/regional testing center for L.E. products.

Strengthen Existing Institutions

1. Provide assistance to L.E. agencies to add personnel knowledgeable on equipment.
2. Strengthen NILECJ's ESIP capability.
3. Help L.E. agencies to set up equipment libraries.
4. Promote cooperative arrangements on information gathering and equipment acquisition between L.E. agencies.

Figure 1. (Continued)

5. Assist small companies to operate in the L.E. market through information services, joint purchasing arrangements, joint ventures with large companies, etc.

Legal Actions

1. Conduct feasibility studies in cooperation with Schools of Law to identify legal areas acting to inhibit development and utilization of various types of equipment, and which might be amenable to change.
2. Explore feasibility of legal strategies (e.g., anti-trust actions) to deal with any constraint of trade situations.

Provide Funds

1. For purchase of specific, new, innovative equipment
2. For training, seminars, etc.
3. For setting up new cooperative arrangements and joint ventures (with producers and government)
4. For setting up information centers
5. For setting up equipment centers
6. For permitting information exchange
7. For R&D programs of high risk (especially to small business).

Market Aggregation

1. Encourage joint purchasing arrangements
2. Encourage and train users to adopt nationwide standards and specifications
3. Develop international markets for L.E. products.

Develop Procedures

1. Send out recommendation and guidelines on (for example):  
Cooperation  
Testing and evaluation  
Information exchange.

Design Model Programs

1. Cooperation programs
2. Industry-user programs
3. Training programs.

Figure 1. (Continued)

Provide Advisory Service

1. Set up national and regional consulting groups.

Provide Training

1. On equipment selection, testing, etc.
2. On equipment selection, utilization.
3. On equipment selection, maintenance.
4. On equipment selection, implementation.
4. On equipment selection, cooperation.

Standards, Testing, Analyses, Evaluations

1. Set up national/regional testing facilities (governmental and/or supporting non-profits, e.g., IACP).
2. Create equivalent of Product Consumer Report.
3. Create product standards -- at user level of understanding as well as the more technical types useful for producers.

1.2 Our Research To Date

The research program and suggestions for further study contained in the following pages describes a first attempt to lay down the base for the required policy formulation and implementation implied above. In the study conducted by us over the past year we investigated the following issues which we had identified as being of critical concern to law enforcement agencies. This was based on our analysis of R&D systems and of an initial survey of 72 user, producer, distributor and related organizations and from consultations with a number of law enforcement equipment specialists in the public and private sectors in the Spring of 1974, and the deliberations of a joint Northwestern/NILECJ workshop following that pilot study. Data on these issues were then gathered in an in-depth focussed study from 132 additional organizations in the Fall of 1974. The eight issues investigated were:

• The Producer Research, Development and Engineering Process

Producers vary greatly in their ability and willingness to develop new products for the law enforcement field. Understanding these factors and the problems producers encounter in developing new equipment for L.E. users is necessary to develop policies designed to improve the equipment innovation process.

Specific sub-issues are concerned with producers' willingness to manufacture and invest in L.E. product areas, their capabilities to produce for these markets, use of external funding to support R&D, project selection criteria, use of specifications, primary problems encountered, information sources utilized, cooperation amongst producers, and testing procedures for new products.

• Marketing

The sub-issues covered are the characteristics of the markets for L.E. equipment, the means of distribution and procedures by which products are sold.

The marketing characteristics include the size and competitiveness of the market, and the degree to which the L.E. product being produced is also made for non-L.E. applications. We are also concerned with the attractiveness of this L.E. market to producers.

The manner of distribution includes not only direct sales and the characteristics of the salesman servicing this market but all other means of distribution, such as catalogue sales, manufacturers' representatives and distributors.

Selling procedures explore the allocation of marketing resources to reach the law enforcement market. This includes the need for demonstrations, technical services and problems unique to serving the law enforcement field.

• Information Transfer And Dissemination

This covers communications from producers to users, other sources of information by which users learn about products, communications from users to producers and between users.

Specific sub-issues are concerned with type and adequacy of information available, sources and credibility of the various information sources to L.E. users, the feedback from users to producers and the extent to which producers encourage and utilize such feedback, and the patterns and extent of user to user communications.

• Need Identification

This is the process by which user agencies perceive needs for equipment and by which producers perceive market opportunities. Does a perceived operational deficiency cause a user agency to search for a technological solution or does an awareness of an available technology cause a user to see where operational improvement is necessary? Does the opportunity or potential for sales to law enforcement come from user agencies in search of a technology or from the producer detecting or suspecting an opportunity and responding by developing or adapting a technology to the L.E. application?

• Cooperation Between Users

To what extent do L.E. agencies engage in cooperative activity with each other regarding the acquisition and/or use of equipment? Of interest are the sub-issues of: which agencies cooperate, with whom do they cooperate, and which equipment and processes are involved in the cooperative activity.

• Funding and Budgeting

The issues here cover the availability and means of acquiring of funds from various sources for both the development of new L.E. equipment and the purchase of such products. The flexibility of user budget procedures and potential constraints that arise from using outside funds is examined.

Specific sub-issues include, amount of funds expended in purchasing new innovative equipment, types of products for which users seek outside funds, constraints and limitations imposed by funding agencies, typical funding periods and rigidities in user budgeting procedures and effects, if any.

• The Acquisition Process

This includes evaluation, testing, bidding, selection of a source and of equipment, and purchasing -- the steps taken after there is sufficient interest on the part of the user to initiate an active search for a certain type of equipment up to the point where a specific model is acquired from a producer. These steps are not employed by all users and also vary considerably in timing, priority, and formality of the procedures used.

Specific sub-issues investigated include; mechanisms and arrangements for product acquisition, events prompting action to acquire new equipment, the role of key user personnel, the role of local politics, new product selection criteria and problems encountered in the acquisition process.

• Installation, Utilization, Maintenance & Assessment

This issue focuses upon what happens to an innovative piece of equipment after it has been purchased by a user. Not all users find that newly acquired equipment measures up to expectations. Factors are identified which appear to have a significant effect upon whether or not the potential of a piece of innovative equipment is realized by its purchaser.

Sub-issues examined include such questions as whether L.E. users are able to effectively utilize existing products, the extent of L.E. users technical preparedness and training to utilize innovative equipment properly, whether resistance to change is a threat to effective utilization, and the extent to which equipment maintenance is a serious problem in law enforcement.

Data was collected on these issues from 47 user agencies, 71 producers, 12 intermediary organizations and 8 distributors, and was supplemented by 62 interviews of individual users at the Traffic Institute. This data has been completely reviewed in a formal analysis. The findings and discussion of implications and potential policy options will be presented in this report in Volume II.

In addition to analysis of the data along the lines of the issues described above we also carried out investigations of our data on several other dimensions. The first of these is by product type. We collected data on ten types of product which were specifically selected because of their variation by law enforcement applications area, technology level and other factors to be described. These were: body armor; holster - utility belts; low light photography - surveillance equipment; non-lethal weapons; portable transceivers; vehicle locators; voice identification; weapons' detection; building design for courts and prisons; court recording systems.

For each of these products an analysis was made of such questions as state of the art, current availability, usage, etc., as well as cross relating each of the issue areas described above to its specific manifestation for the product concerned.

We have collected data on such questions as: what is and has been recently available in the market, who are the producers -- identifying main and secondary sources (by share of market, where possible), what the products cost, the products; function in L.E., who uses the product (by type of user and by function), is the product being well or poorly used, what do L.E. people feel they need in this product area, what changes are taking place in the product (type of, rate of, source of), what do producers have coming along? Case study histories for each product type were developed.

We can see from the data that NILECJ will need to vary its strategies for various product categories if it is to have a successful technology innovation and diffusion program. Other analyses were carried out by types of participant in the law enforcement equipment R&D system. These were by type of user agency (large metropolitan, city, small suburban, private, etc., prisons, courts, etc.), by type of producer (by size - large, medium, small and tiny, and by technology level), and for intermediary organizations and distributors.

Based on the results of this analysis, we have developed a model of the R&D System for law enforcement equipment. This model has been organized in twelve stages representing both the supply and use dimensions. For each of these stages we have developed an abbreviated policy oriented overview of key issues, a review of NILECJ's effort in the specific area concerned and alternative policy options. This is presented in the next section (1.3).

### 1.3 The R&D System for Law Enforcement Equipment and Summary of Issues

The following notes contain a very simplified and abbreviated model of the system. Keyed to each of twelve stages of the system is an analysis under the following headings:

- Issues (relating to that stage)
- ESIP Effort (a summary review and critique)
- Policy Options (for NILECJ)
- Northwestern Programs
- Studies Recommended to NILECJ

Several of the stages have been grouped for ease of presentation resulting in eight topics, each using the above format. These topics are:

#### Relevant Stages

1	Need Identification
2	Investment and Funding
3	R&D Process and User Search
4	Producer Production
5	Marketing and Bidding
6 through 9	Sales/Service and Selection/Implementation
10	Feedback
11	Cooperation
12	Federal (NILECJ) Roles

The discussion and program titles described in these notes all key into the full proposal.

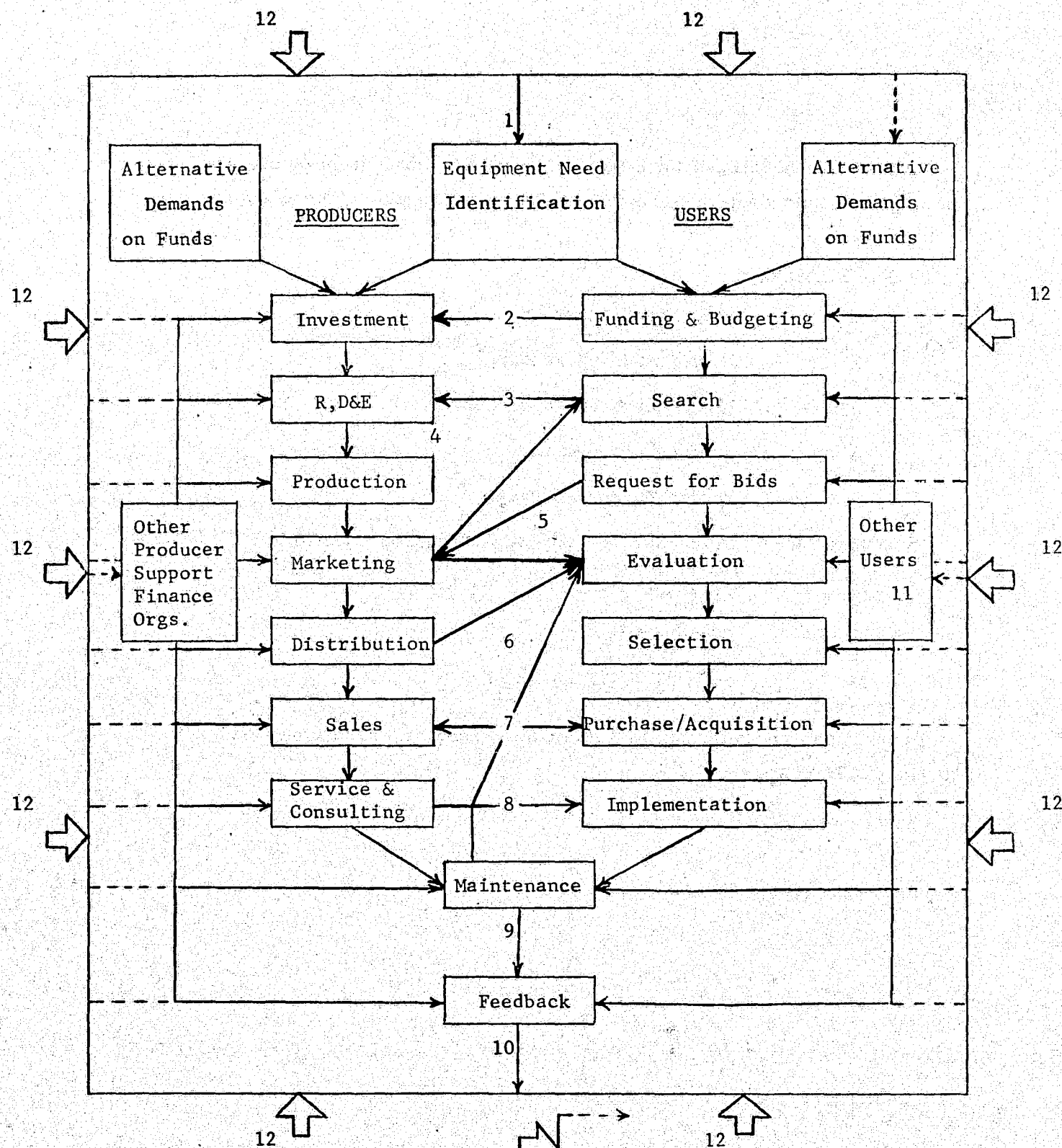


Figure 2.  
Simplified Model of the R&D, Innovation, Diffusion  
 and Implementation System

Stage 1 - R&D System: Producer and User Need Identification

Issues

Producers

- Poor understanding of User needs and equipment opportunities
- Poorly developed L.E. market research capabilities
- Poor perception of L.E. markets (less so for smaller firms)

Users

- Poor recognition of equipment potential in L.E.
- Define needs poorly - on crisis basis
- Not innovation oriented
- Little capacity for planning and self evaluation

ESIP Effort

- The N.B.S. survey of needs and the MITRE mission (NILECJ's information dissemination program also relevant). Conception appropriate in part. Execution not satisfactory to needs. No useful input potential to Producers (identifying opportunities or helping stimulate Producer market study - especially small firms) Survey done to and for Users - should be helped to develop own need identification capabilities, improve interaction with Producers. MITRE personnel in L.E. agencies good concept in the original program - but wrong personnel, wrong concentration. (Present ATD effort still to be studied.)
- Producer marketing areas - none
- User capabilities areas - none

Policy Options

- Expand Information clearinghouse NCJRS into full cooperative (producer/user)
- Stimulate Producer/User contacts - conferences, workshops
- Help smaller Producers identify opportunities - newsletter, seminars, as satellites of large firms
- Engage in (as now) and also support studies on and promote information dissemination of equipment utilization in L.E. systems
- Improve User capabilities on need identification - training, demonstration, consulting services.

Northwestern Program

1974 Efforts

Following relevant issues studied:

- Need Identification
- L.E. Markets
- Information Dissemination

Stage 1 (Continued)

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Information Dissemination (including field experiment)
- Upgrading User Capabilities (issues and methods including training programs design)
- Problems of and Opportunities with Small Producers
- Design of a Model Equipment Center (assist in identifying equipment usage opportunities)

Future Studies

- Assistance to Small Users
- Studies of Equipment Utilization in L.E. Systems
- Studies of Specific L.E. Products and Usage

Stage 2 - R&D System: Producer Investment and User Funding and Budgeting

Issues

Producers

- Low willingness to invest in the innovative L.E. equipment field
- Federal support funding difficult to obtain - especially for small producers

Users

- Very small portion of total budget goes into equipment acquisition (most of that to automobiles and communications)
- Users not inclined to distribute presently available funds for long term commitments to innovative equipment or programs

ESIP Effort

- Provided subsidies to specific company effort (radio)
- Paid for specific product R&D programs through Aerospace program. These programs did not provide for the larger downstream investment risks and costs. Lack of integrated total system plan (including commercialization). Did not help those companies able and likely to play significant commercial R&D role. Help limited to R&D phase.
- General L.E. investment issues - none
- General funding issues - none

Policy Options

- Continue to pay for selected R&D costs, but;
  - a) supplement as well as compete with existing capacity
  - b) channel to companies willing and able to significantly commercialize
  - c) stimulate large/small company joint ventures
  - d) seeks ways to reduce Producer hesitancy in using federal funds (due to loss of proprietary rights)
- Provide support for other stages of the system (e.g. market research, consulting)
- Work with federal and private finance sources to stimulate investment in the L.E. equipment business
- Work with Users to provide more effective financial support for equipment experimentation, utilization and acquisition programs
- Create educational and information dissemination programs aimed at motivating L.E. agencies and helping their justification for increased spending within their budgets for equipment
- Help to aggregate User purchasing capabilities through cooperation between Users

Stage 2 (Continued)

Northwestern Program

1974 Efforts

Following relevant issues studied:

- Funding and Budgeting
- L.E. Markets (willingness to invest)
- R,D&E Process (willingness to invest)

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Cooperation Between Users
- Small Producers

Future Studies

- Small Users
- Uses of LEAA funds for innovative equipment

Stage 3 - R&D System: Producer R&D and User Search Processes

Issues

Producers

- Generally unwilling to invest in L.E. product R&D
- Many lack both resources and technical capability
- Most engineering consists of minor adaptations of products developed for other markets
- Very little adequate technology transfer from other federal efforts
- Lack of accepted, adequate product standards
- Isolated products are generally not viable - must be seen as part of complex man and equipment systems

Users

- Poor knowledge of product availabilities, sources and performance
- Inadequate technical and operational search capabilities (even in the larger agencies)
- Virtually no satisfactory consulting and support services available
- Poor User-to-User information exchange
- Lack of proper standards in usable form (for them)
- Tendency to treat IACP listings as standards

ESIP Effort

- Aerospace program to produce specific R&D outputs
- N.B.S. Standards program

Within the limits of its assigned mission, the Aerospace program is the most satisfactory part of ESIP, but impact is confined to the R&D stage. And it is limited to a few areas and to providing R&D outputs rather than helping create Producer R&D capacity, especially in smaller companies interested in the L.E. market.

The standards program is not helping the Producers who, in turn, are not able to satisfy the Users. The standards program is not giving Users what they need (a consumer's report approach).

- Overall Producers R&D issues - none
- User capability areas - none
- User information exchange areas - none

Policy Options

- Provide financial assistance to companies having own R&D project plans
- Limit federal R&D projects to proof on concept stage - except for very novel products

(Stage 3 continued)

- Stimulate User demand for innovative products ( see Stages 1 & 2 above )
- Assist in the development of standards that have Producer and User credibility and usability (may well be different):
  - a) through cooperation with industry groups and others such as IACP
  - b) through help to create a "consumer's report" type of publication
- Continue the support of specific R&D efforts (see Stage 2 above) (as one and only one element in a program) but emphasizing men and equipment systems rather than products in isolation
- Provide training to Users in search processes
- Create Information Clearinghouse (as above)
- Improve information dissemination processes
- Encourage User interchange and cooperation programs

#### Northwestern Program

##### 1974 Efforts

Following relevant issue areas studied:

- Producer R,D&E process
- Information Transfer and Dissemination
- Cooperation between Users

#### Studies Recommended to NILECJ

##### Proposed Studies (1975/76)

- Information Transfer and Dissemination (including field experiment)
- Cooperation between Users (including training programs)
- Upgrading User capabilities
- Small Producers
- Development of Federal Strategies for Product Development and Commercialization
- Regional Equipment Centers (as an information and demonstration source)
- International Cooperation (joint R&D efforts, availability of sources abroad)

##### Future Studies

- Small Users
- "Consumer's Report" approach to standards information dissemination to Users
- Technology Transfer from other areas of government

#### Stage 4 - R & D System: Producer Production

##### Issues

###### Producers

- Lack of enthusiasm to invest in L.E. requires that new product be capable of production with present facilities.
- Size and segregation of the market indicates that short-run, intermittent production schedules are required. High-production, highly-automated production processes generally inappropriate for most products in L.E.
- Production standards in terms of user requirements are often difficult to define.

##### ESIP Effort

- None

##### Policy Options

- Cooperate with other government agencies (e.g. SBA) to provide financial assistance to small producers willing to develop necessary production capabilities.
- Work with producers or producer associations to develop user-oriented production standards.
- Market aggregation programs (see Stage 5)

#### Northwestern Program

##### 1974 Efforts

Following relevant issue areas studied:

- Extent of perceived aggregation of market
- Willingness to invest in L.E. market

#### Studies Recommended to NILECJ

##### Proposed Studies (1975/76)

- Small Producers
- Regional User cooperative programs aimed at market aggregation.



Stage 5 - R&D system: Producer Marketing and User Bidding Processes

Issues

Producers

- Doing haphazard job of informing Users of product availability and performance qualities
- Generally low field sales competencies
- See many problems in market (small, diffused, fragmented, low volume, unskilled decisions, low budget, high politics, low profit, high distribution costs, and hampered by the bidding process, non-competitive in high technology areas and too competitive in the low.)
- Some companies find the market quite attractive
- Bidding specifications are often product not performance oriented

Users

- Competitive bidding (not controlled by the L.E. agencies) creates problems (complex and lengthy)
- Specifications often designed by specific selling companies

ESIP Effort

- None

Policy Options

- Investigation of Market sector characteristics
- Efforts to decrease market disincentives (see Stage 2 - Policy Options above)
- Market aggregation programs;
  - a) Joint efforts with product related sectors (eg. fire, ambulance, trucking)
  - b) International programs
  - c) Cooperation programs (in geographic regions)
  - d) Federal purchasing
  - e) Promotion of the use of common standards
- Study the various roles played and costs incurred at the marketing stage (technical service, design, maintenance)
- Legal actions to deal with non-competitive sectors
- Investigation of alternatives to the Bidding policy

Northwestern Program

1974 Efforts

Following relevant issue areas studied:

- Marketing
- Acquisition Process (including Bidding)

(Stage 5 continued)

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Small Producers (particularly commercialization role)
- Development of Federal Strategies for Product Development and Commercialization
- International Cooperation

Future Studies

- Additional methods of Market Aggregation

Stages 6 through 9 - R&D System: Producer Distribution, Sales, Service and Consulting; User Evaluation, Selection, Acquisition, Implementation and Maintenance

Issues

Producers

- Distributors are technically weak and generally limited to small, low technology products
- The technical and systems weakness of Users requires many Producers to provide significant technical service as part of selling effort
- Service is very varied in quality by product type and region
- Small Producers find selling to many small scattered Users difficult and expensive
- Many Users are slow payers - creates cash flow problems for small firms
- Virtually no quality technical non-manufacturer consulting is available to L.E. agencies

Users

- Lack professional in-house evaluation and selection capabilities
- Testing, Evaluation and Selection processes are haphazard, unreliable and based on limited information. Considerable use of localized word-of-mouth recommendations.
- Usable standards are not available (see 3 above)
- Lack testing capabilities or facilities
- Weak in-house implementation capabilities
- Poor utilization of existing equipment
- Poor equipment maintenance

ESIP Effort

- NBS standards program ( see 3 ESIP Effort above)
- Field evaluation plans of ATD
- Other areas - none

Policy Options

- Work with small companies to develop regional distribution, design and technical service firms - possibly based on small manufacturers subbing to bigger firms (or licensees)
- Investigate the setting up of purchasing cooperatives to aggregate the markets for low cost and repetitive items
- Investigate federal loans to small firms to finance cost of doing business with L.E. agencies

(Stages 6 - 9 continued)

- Build up L.E. agencies' in-house evaluation, selection, implementation and maintenance capabilities
- Develop regional testing centers
- Develop regional consulting services

Northwestern Program

1974 Efforts

Following relevant issue areas studied:

- User Acquisition Process
- Marketing (included Sales procedures)
- Distributors
- Installation, Utilization, Maintenance and Assessment

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Development of User In-house Capabilities
- Small Producers
- Regional Equipment Center (information and possible testing and consulting roles)

Future Studies

- Small Users
- Regional Testing Centers
- Development of and Training for User Equipment and Systems Evaluation Processes

Stage 10 - R&D System: Feedback

Issues

Producers and Users

- Virtually no systematic feedback from Users to Producers
- No information available on what's happening abroad

ESIP Efforts

- Virtually none. Some effort extended in soliciting reactions from Users on Body Armor. Information had not yet found its way into Producer community

Policy Options

- Information clearing house
- Information transfer programs (see Stage 1)
- International Cooperation Programs

Northwestern Programs

1974 Efforts

Following relevant issues studied:

- Need Identification
- Information Transfer and Dissemination

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Information Transfer and Dissemination
- International Cooperation

Stage 11 - R&D System: Other Organizations

Issues

Producers

- Lack of support organizations - consultants, testing laboratories, merchandising
- Not clear how attractive industry area is to financial organizations as investment site

Users

- Not sufficient advantage being taken of cooperative opportunities
- Lack of training and mechanisms to promote cooperation

ESIP Efforts

- None

Policy Options

- Assist organizations willing to enter into support roles
- Provide training for people wishing to enter this sector
- Through LEAA grants program encourage User cooperation programs
- Investigate issues in various types of cooperation efforts
- Provide training for cooperation and disseminate experience

Northwestern Programs

1974 Efforts

Following relevant issues studied:

- Cooperation between Users

Studies Recommended to NILECJ

Proposed Studies (1975/76)

- Cooperation between Users (including training)

## Stage 12 - R&D System: Federal Roles

### Issues

- NILECJ policy has leaned too heavily on developing new R&D products and new standards and pushing these out to Producers and Users as relevant for further action. This strategy fails to benefit from the pull that can be developed by building up Producer and User capabilities and motivations to want to innovate, adopt and hence produce new products.
- NILECJ has been involved in only a few stages of the system
- NILECJ lacks the in-house capability to plan work in and monitor relevant work at all these stages
- There has been insufficient development of support for NILECJ's efforts amongst Producers, Users or relevant associations
- NILECJ has not developed a wide enough base of support organizations (universities, non-profits) pursuing relevant research on the L.E. equipment R&D system.

### ESIP Efforts

- The issues seem hardly to have been recognized. ESIP is a limited ad-hoc effort. To the extent that the policy gap has been seen the response was to push the issue to Aerospace rather than build up NILECJ's own capability (with the support of the non-profits and universities - not abdication to them or us). While there are some worthwhile elements to the program and some good specific concept - in total it doesn't add up to a program and as such even the good is largely likely to be wasted. If not re-cast, the whole program becomes subject to serious question.

### Policy Options

- Develop a policy planning capability for ATD with requisite skills and external support
- Develop a program portfolio that deals with the whole system - but recognizes where NILECJ has leverage opportunities
- Concentrate the program on developing Producer and User capabilities and incentives rather than feeding them finished concepts to implement or commercialize
- While aware of the difficulties and resistances - try to work in cooperation with industry and User associations - develop legitimacy
- The use of joint conferences with NILECJ support should be considered
- Develop a network of non-profits and universities capable of and interested in supporting the overall program

(Stage 12 continued)

### Northwestern Programs

#### 1974 Efforts

- Study of total R&D System
- Definition of stages and issues

#### Studies Recommended to NILECJ

##### Proposed Studies (1975/76)

- Further Analysis of 1974 issues and data
- Development of strategies for Federal Government Policy for Product Development and Commercialization

##### Future Studies

- Studies of joint ventures with other arms of government
- Policy options through creative use of LEAA funding
- Proposals to improve NILECJ's capability in equipment system areas
- Examination of potential role of universities and other non-profit research organizations in a stable on-going program

#### 1.4 Project Selection Criteria and Program Portfolio Evaluation Strategy for NILECJ

The following materials are divided into five sections:

- . Overall Project Selection Strategy
- . Project Evaluation Criteria
- . Suggested Additional Products for Aerospace Corporation
- . Programs for National Bureau of Standards
- . Suggested Programs in Addition to Aerospace and NBS

These materials were created in specific response to NILECJ request and on our recommendation that we could provide such inputs based on the findings of our 1974 research program and policy recommendations.

##### 1.4.1 Overall Project Selection Strategy

It is vital that the development projects being supported by NILECJ represent a "balanced portfolio." By balanced we are implying that the project portfolio should consist of a distribution of product development programs that vary across the following dimensions:

1. Application area (targetted for various L.E. functions)
2. Time horizon (for both technical completion and systems implementation with potential producers and users i.e. commercialization and implementation) and risk (both technical and systems)
3. Project size (costs at all phases of the system)
4. Number and location of gaps being filled (product availability, R&D capacity, user capability etc., i.e. does the product fill a well established need in a developed commercial market or is this a product requiring new types of R&D manufacturing and marketing capabilities and does it require new user conceptions of L.E.?)

The first point here is that NILECJ should avoid slipping into a portfolio that is overly targetted to one L.E. function and which is concentrated on only large projects of high risk, long time horizons for completion and all of which depend on the same areas of commercial weakness. The second implicit point is that decisions must be made both on a total portfolio impact as well as project

by project basis.

The programs should reflect a distribution across functions in terms of the potential impact of the project on law enforcement in general. NILECJ can, for example, use the same approach as used by MITRE Corp., that is, weighting the different functional areas of the Criminal Justice System according to the problems currently faced in each area. The areas, as distinguished by MITRE are:

Police  
Prevention - Detection - Investigation - Apprehension - Communication  
Courts  
Pre-trial  
Trial  
Corrections  
Security  
Community  
Prevention  
Detection and Reporting

A key question is how important will this equipment be to improving the particular aspect of the L.E. function involved?

The time horizon and risk aspects should explicitly consider both the need for early program outputs to legitimate and sustain overall program objectives in the equipment development area, and the requirement for a continuous distributed flow of outputs of varying degrees of novelty and scope. In general (though not inevitably) the less ambitious or novel the program, the shorter the time horizon and the less the risk, but the less the potential impact. The more ambitious riskier projects can usually be expected to take longer not only to technical completion but also to commercialization and implementation. NILECJ must support both kinds (and gradations between the extremes.) The actual balance has to be determined as a policy judgement within NILECJ based on both requirements of the field and political and fiscal questions. Included here must be considerations of the desired flow and timing of outputs, expected patterns of required fiscal support at various project stages, and expectations of funds likely to be available.

This leads to the third aspect - costs which should allow for a balance between a few high cost ventures that use up most of the available funding and many small projects. The same considerations as above apply.

Finally the program must take explicit account of the systems issues that will be encountered even if the technical aspect is successfully completed. The product or system must be commercialized, accepted and implemented by the community of L.E. users and be acceptable to society at large on both legal and social grounds. A method of explicitly considering each of these aspects is provided. The point now is that there must be balance in the portfolio between projects that will face up to many large system problems or gaps and those that will be capitalizing upon many existing strengths and support areas. In general the overall strategy should be as follows:

- a) For short time horizon projects - work towards utilizing existing strengths ( i.e. existing R&D, manufacturing, marketing and support capacities and well established user acceptance and abilities.) The objective here is to fill a specific gap ( or two ) that would then permit the total process to continue on its own.
- b) For long time horizon projects - work towards creating new capacities in the system ( i.e. products that will lead to new fields and applications, new commercial R&D, marketing capacities etc.) The objective here is to stimulate expansion of the field.

These are not meant to be invariant criteria but general guidelines. NILECJ should avoid having many short run projects that will each face many large commercialization and implementation barriers. As important it should be careful not to use a strategy that is suitable for a long range project for a program that should be treated as a short range effort. Thus if a proposed development program involves a product whose use is generally well understood and accepted, and for which there already exists a well established commercial sector, the strategy should be to work with these existing strengths. This could be done by coopting the existing commercial and support sectors into the development, testing, evaluation and commercialization processes and contrasts with an independent NILECJ supported program that in effect acts to duplicate and compete. The Body Armor program might be such an example of using an inappropriate strategy even though the technical product development aspect was very successful.

In the next section specific project evaluation criteria are presented.

#### 1.4.2 Project Evaluation Criteria

For each of the criteria below the following rating system is used.

##### A. Strength/Weakness Rating

Can the described factor be considered as a strength or a weakness, a resource or a gap to be overcome in terms of the commercialization and utilization of the equipment? The ratings are shown as follows:

strength or resource	+
weakness or gap	-
neutral or irrelevant	0
unknown	?

##### B. Time Horizon and Cost

If something needs to be done in relation to the issue, can this be achieved quickly and cheaply or must a long time delay and high cost of intervention be anticipated? The ratings are as follows.

Long Delay	L
Short Response	S
High Cost	H
Inexpensive	I

##### C. Comments and Critical Factors

Notes should be made of any specific factors that must be kept in mind in relation to the issue concerned. Particularly, this concerns what we define as "critical factors." These are factors which will control all other aspects and without solution ( or availability ) nothing can be expected to proceed. Examples would be the lack of a required material at the R&D stage or the passage of a new law permitting use of the product, at the implementation stage.

The overall objective will be to rate the equipment project on each of the indicated factors and then to summarize the total rating on all factors in an overall profile. The extremes on the continuum of this profile are:

1. Short time horizon equipment programs that can easily and/or inexpensively be integrated into well developed producer and user systems
2. Long time horizon equipment programs for which many difficult and/or expensive barriers will need to be overcome before the equipment can be integrated into or supercede those producer and user systems having the many gaps and areas of weakness.

Two types of criteria are specified: Technical & Systems. These criteria can be used for both pre- and on-going project evaluation phases.

##### 1. Technical Criteria

Aerospace Corporation has already provided NILECJ with a format for project evaluation which appears adequate for the technical aspects. These are:

Technical Factors

Risk

Time to Develop

Degree of Improvement over Status quo.

R&D Costs

NILECJ should ensure that the above criteria have been applied to each of the Aerospace projects and that it is fully informed of the relevant data. If desired these factors could also be considered using the rating format developed by the Northwestern team for the Systems criteria below.

The above evaluations require technical expertise. Some of these factors can best be evaluated by NILECJ personnel. Where NILECJ in-house capability is lacking, outside competency should be procured. A reputable private consulting firm could be retained to evaluate projects using its own standardized evaluation procedures and any criteria for which NILECJ lacks competence.

2. System Criteria

In addition to the foregoing, NILECJ ( as well as an external consultant ) should evaluate each Aerospace project on the basis of its impact on the L.E. innovation equipment development - delivery - utilization process. To do this the following criteria are suggested:

Issue Areas	Strength/ Weakness Mark + - 0 ?	Time Horizon & Cost Mark		Comments and Critical Factors - Indicate.
		L/S	H/I	
<u>Stage 1* - R&amp;D System: Producer and User Need Identification</u>				
<u>a) Producer</u>				
1. Recognition of opportunity in this equipment area.				
2. Market research capabilities in this area.				
<u>b) User</u>				
1. Recognition of need.				
2. Priority for this equipment.				

\* These stages key in to the R&D systems model shown in the attached document.

	+ - 0 ?	L/S	H/I	Comments
3. Present usage of this type of equipment. <u>Other Factors</u> ( add as required )				
<u>Stage 2 - R&amp;D System: Producer Investment and User Funding and Budgeting</u>				
<u>a) Producer</u>				
1. Willingness to invest in innovation in this equipment field? In what phase?				
- Research				
- Development				
- Engineering				
- Production				
- Marketing				
- Service and Support				
2. Financial strength of the firms likely to be Producers of this equipment.				
3. Potential profitability and ROI.				
4. Likelihood of commercial investment companies backing this product area.				
<u>b) User</u>				
1. Portion of users' total budget going into funding products of this nature.				
2. Likelihood of LEAA funds being available for such products.				
<u>Other Factors</u> ( add as required )				

	+ - 0 ?	L/S	H/I	Comments
<p><u>Stage 3 - R&amp;D System: Producer R&amp;D and User Search Processes</u></p> <p><u>a) Producer</u></p> <ol style="list-style-type: none"> <li>1. R,D&amp;E capabilities available to enter this market.</li> <li>2. Likely impact on R,D&amp;E capacity.</li> <li>3. State of the art in the area.</li> </ol> <p><u>b) User</u></p> <ol style="list-style-type: none"> <li>1. Available information sources and search processes for this type of product.</li> <li>2. Motivation to make effort to look for this type of equipment.</li> </ol> <p><u>Other Factors ( add as required )</u></p>				
<p><u>Stage 4 - R&amp;D System: Producer Production</u></p> <p><u>a) Producer</u></p> <ol style="list-style-type: none"> <li>1. Capabilities currently existing to manufacture this product.</li> <li>2. Materials required.</li> <li>3. Processes required.</li> <li>4. Facilities required.</li> <li>5. Production standards required.</li> </ol> <p><u>Other Factors ( add as required )</u></p>				

	+ - 0 ?	L/S	H/I	Comments
<p><u>Stage 5 - R&amp;D System: Producer Marketing and User Bidding Processes</u></p> <p><u>a) Producer</u></p> <ol style="list-style-type: none"> <li>1. Producers' perceptions of the market potential for this product.</li> <li>2. Characteristics of the current market for this product in terms of commercialization. List key barriers in comments.</li> <li>3. Competitiveness of market.</li> <li>4. Extent to which commercialization can be done by existing institutions. Comment on new arrangements that may be required.</li> <li>5. Complimentarity or competitiveness of equipment to existing products.</li> <li>6. Adequacy of marketing techniques for this area.</li> <li>7. Life expectancy of product (versus obsolescence).</li> </ol> <p><u>b) Users</u></p> <ol style="list-style-type: none"> <li>1. Receptivity to being able to purchase this product.</li> <li>2. Bidding requirement.</li> <li>3. Likely price of this product (will it limit the commercialization of this product?)</li> <li>4. Responsiveness to type of marketing that will be required.</li> </ol> <p><u>Other Factors ( add as required )</u></p>				



	+ - 0 ?	L/S	H/I	Comments
<u>Stages 6 - 9 - R&amp;D System: Producer Distribution, Sales, Service &amp; Consulting; User Evaluation, Selection, Acquisition, Implementation, and Maintenance</u>				
<u>a) Producer</u>				
1. Ability of the distribution system in terms of technical capability of handling the likely level of technology.				
2. Distributions system's capability of contacting the type and/or number of target user agencies.				
3. Degree to which producers (or others) are equipped to provide the required level of: <ul style="list-style-type: none"> <li>- technician service</li> <li>- technical consultation</li> <li>- personnel training</li> </ul>				
<u>b) User</u>				
1. Target user agencies possession of in-house capability to evaluate the technical and systems features of the project output.				
2. Adequacy of the operational standards required by the target user agencies.				
3. Competence of sources of external technical and/or systems evaluation available to user agencies.				
4. Willingness of target user agencies to make use of necessary external consulting (evaluation) services.				
5. Target user agencies flexibility of organization and/or procedures necessary to absorb the project output.				
6. Facilities and/or opportunities for adequately field testing the project output.				

	+ - 0 ?	L/S	H/I	Comments
7. Target user agencies degree of expertise for maintaining the project output.				
8. Legal regulations regarding the use of this product.				
9. Civil or community reaction factor.*				
<u>Other Factors ( add as required )</u>				
<u>Stage 10 - R&amp;D System: Feedback</u>				
<u>a) Producer</u>				
1. Extent to which producers maintain contact with and are receptive to their users on a continuous basis.				
2. Extent to which producers in this field solicit and make use of feedback in this area from: <ul style="list-style-type: none"> <li>- other countries</li> <li>- other disciplines</li> <li>- other user groups</li> </ul>				
<u>b) User</u>				
1. Adequacy of mechanisms to feed their reactions back to producers.				
2. Use made of available feedback mechanisms.				
<u>Other Factors ( add as required )</u>				

\* This factor appears in the Aerospace criteria ( suggested by MITRE ).

	+ - 0 ?	L/S	H/I	Comments
<u>Stage 11 - R&amp;D System: Other Organizations</u>				
<u>a) Producer</u>				
1. Availability of support organizations in the L.E. system for this type of equipment. <ul style="list-style-type: none"> <li>- Technical experts</li> <li>- Testing laboratories ( during R,D&amp;E )</li> <li>- Distribution channels</li> </ul> 2. Existence of producers or producer-oriented organizations that are not presently involved in L.E.				
<u>b) User</u>				
1. Availability of support organizations in the L.E. system for this type of equipment. <ul style="list-style-type: none"> <li>- Equipment experts</li> <li>- Testing laboratories</li> <li>- Market research</li> <li>- L.E. systems analysts</li> </ul> 2. Existence of user-oriented organizations or associations that are not presently involved with L.E. in the area of: <ul style="list-style-type: none"> <li>- Technical expertise</li> <li>- Testing facilities</li> <li>- Market research</li> <li>- Organizational/systems analysis</li> </ul> 3. Possibilities and likelihood of cooperation in use or acquisition of this equipment.           4. Availability of support from consultants.				
<u>Other Factors ( add as required )</u>				

	+ - 0 ?	L/S	H/I	Comments
<u>Stage 12 - R&amp;D System: Federal Roles</u>				
1. Extent to which other Federal agencies are active in the R,D&E system for this project output.           2. NILECJ's capability to monitor this program at all necessary phases.           3. NILECJ's capability of funding all necessary phases of the program at required level.				
<u>Other Factors ( add as required )</u>				

The above criteria will have developed a profile for an individual project allowing for evaluation on the basis of:

1. how many (which) points of intervention in the R,D&E system are likely to be necessary,
2. which points of intervention are critical, and
3. is the project a long - or short - term or high - low cost project.

The next logical evaluation is based on the strategy necessary. The pertinent questions to be asked at this point are:

1. Should the project be undertaken or dropped from further consideration at this point?
2. When should the project be undertaken? In stages? Several stages concurrently?
3. How should each stage of the project (or intervention) be formulated? What are the optional strategies of intervention?
4. Who should conduct the project activities at each point of necessary intervention?

- NILECJ
- other Federal agency
- Aerospace

- Private producer
- User agency
- Private producer association
- User association

5. Can an individual entrepreneur for the project be identified?

This is critical - no project should be pursued unless a competent and highly motivated key person in a position of significant influence can be identified. Where is he located?

- NILECJ
- other Federal agency
- Aerospace
- Private producer
- User agency
- Private producer association
- User association

#### 1.4.3 Suggested Additional Projects for Aerospace

The projects listed in this and the following two sections represent suggestions for areas of activities that would be part of a strategy to ease the equipment improvement program of ATD into a changed profile. In making these suggestions we are recognizing the constraints that were indicated to us in terms of commitments and planning based on programs at Aerospace and NBS. As such this would represent a beginning to our recommendation that NILECJ's program be shifted to the total systems perspective we have described. Planning should begin immediately so as to permit a greater shift in the funding for the next fiscal year.

As regards the Aerospace program we are not taking any position on the sole source versus competitive issue. The issue that we have dealt with is that of what work should be going on at a source such as Aerospace, whether the source be that company, another, or a group of suppliers. Naturally NILECJ should itself, or with outside help from a technical consult, determine the relative capacities of various sources.

In addition to continuing its R&D development work, Aerospace should be asked to look at:

1. Feasibility study of a model equipment center (cooperative study with Northwestern group).
2. Identification of long range R&D capabilities required by the L.E. system versus their current availability (government, industry, university).
3. Increase efforts with small firms, i.e., experiment with subcontracting low level technology projects to small producers who will become involved in commercialization, etc.
4. An equipment systems design utilizing existing equipment.
5. Identification and feasibility study of equipment specifically targetted to multiple sectors (law enforcement, fire, various commercial sectors, etc.)

#### 1.4.4 Programs for NBS

1. Pursue plans for a pilot program to explicate the feasibility of producing a "consumers report" type of standards program.
2. Develop a plan for organizing committees and/or conferences of users, producers, and representative agencies to:
  - a. determine needs for standards
  - b. promote acceptance and use of standards.(This concept was suggested, originally, in part, by the Institute for Defense Analysis in its report to the President's Commission on Law Enforcement and Administration of Justice in 1967.)
3. Plan and implement a program by which NBS will develop credibility in the field of law enforcement. Such a plan may involve active cooperation with agencies such as IACP (see 2 above)\*.
4. Plan a program by which NBS can make known and supply timely, usable consulting services to law enforcement agencies in need of equipment evaluation services.
5. Conduct a large-scale field test of body armor in L.E. agencies to include products purchased from all reputable manufacturers presently in the field, including Aerospace.

NOTE: Many of these approaches have already been referred to in NBS Report 10-349 "Alternative Plans for a Center for L.E. Equipment User Standards," dated October 1970. This report should be re-examined and re-evaluated with the idea of implementing pertinent portions of the overall plan.

\* This recommendation is made in the full recognition of previous "attempts" in this direction - as seen from both sides. We are suggesting renewed, more creative and more motivated efforts which we believe could be fruitful.

#### 1.4.5 Suggested Programs in Addition to Aerospace and NBS (to be pursued by NILECJ in FY 76)

The following listing represents several programs that could be considered for early implementation in-house by NILECJ.

1. Technical program monitor (for overseeing the Aerospace program).
2. Policy making and planning for FY 76-7 with outside professional assistance in order to upgrade ESIP and NILECJ capabilities as well as develop formal FY 76-7 plan options.
3. Develop a course on the role of technology in the law enforcement system.
4. Plan and implement a program of conducting regional seminars and conferences throughout the U.S. to disseminate selected information on equipment usage, cooperation, joint purchasing, safety, etc.
5. Design and take first steps to implement an information clearing-house.
6. Design and conduct an experiment to test the feasibility of aggregating L.E. markets with other sectors.
7. For additional suggested programs see section 1.5 and volume III of this report. The programs proposed there could be carried out in-house or contracted out and represent both immediate and longer term efforts.

### 1.5 Further Studies that should be Undertaken by NILECJ

As a result of our research we have identified additional areas that should be investigated by NILECJ. These studies fall into the following categories:

#### 1. Further study of issues explored in the 1974 Northwestern study.

These are:

- Cooperation between users.
- Information transfer and dissemination.

These two were selected particularly because of the leverage opportunities they give to NILECJ. By investing some additional resources in these areas the Institute would gain the opportunity to put funds being used in other programs (within LEAA and NILECJ) to work on the equipment system improvement effort.

#### 2. Specification and study of such new issues as:

- Development of upgraded user in-house capabilities and modes of operation.
- Problems of and opportunities with small producers.
- Design of regional centers in which selected equipment and expert assistance would be made available to L.E. users.
- Development of strategies for Federal government policy for product development and commercialization.
- International cooperation to achieve improved information, exchange joint programs and possible market expansion.

Details of these program areas will be given in Section 3 below.

These seven issue areas were selected both for their importance and balance between topics of concern for users, producers and directly for Federal government.

In addition to these seven areas, four more are recommended as a second priority. These are:

- Problems of small users.
- Development of a national/regional center for equipment testing and "consumers report" type of operation.
- Development of and training for user equipment and systems evaluation processes.

- Studies of equipment as part of law enforcement systems (hardware/software relationships).

Nine other topic areas were identified as potential areas for continuing effort in a longer range program by NILECJ.

- Studies of joint ventures between federal, state and local government.
- Mechanisms to improve processes of technology transfer between other areas of government and law enforcement.
- Methods to improve producer perceptions of the law enforcement products markets.
- Studies of additional methods to promote market aggregation.
- Continued studies of policy options available through creative use of LEAA funds.
- Study and proposals to improve NILECJ's capability in the equipment systems area.
- Examination of potential role for universities and other non-profit research organizations in a stable on-going program.
- Specific studies on law enforcement products and operational systems using hardware products.

#### 3. Expansion of studies to other product types such as vehicles, helmets, radar equipment, mobile laboratories, riot control, computers, etc. These are necessary to expand and strengthen the product typology.

#### 4. Expansion of sample and range of user agencies.

These further phases of research will concurrently and sequentially lead to two additional study elements as follows:

#### 5. Carrying out selected experiments and training programs that might act as models for wider dissemination. A major theme of the NILECJ program should be on cooperative action programs which attempt to implement policy outcomes of on-going research. To this end the continuing studies should be supported to result in regular periodic products that can be considered by NILECJ personnel for either input to their own thinking or for trial implementation. The action program areas have been selected within the seven topic areas for further research that were listed above. These are:

- a) Cooperation between users e.g. design of mechanisms for cooperation and creation and pilot testing of "cooperation" training packages.
- b) Information transfer and dissemination e.g. carry out a field experiment in which selected police departments can be fed product information and observations made of their equipment search, acquisition and adoption behavior, with data collected in both the before and after situations and from a matched control sample of users.
- c) Development of user in-house capabilities e.g. design and pilot testing of training courses; development of prototype "canned" (e.g. video taped) training units and pilot testing of the training concepts.
- d) Design of model equipment and expert center - support a study up to feasibility stage to permit NILECJ to consider and implement a commercial contract (or in-house program) to set up such a center (or centers) with LEAA funding.

There is one additional experiment that we are suggesting but for which we recognize there are major problems of implementation to be worked out. This would involve the design and operation of a federally supported but probably regionalized purchasing program in which law enforcement agencies would become part of a much larger buying unit. This might have the dual effect of increasing both buyer power and seller profitability -- by cutting both prices and increasing product values as well as reducing marketing costs. We are open to discussion with NILECJ on this topic.

Further details of these recommended action programs are given in Volume III below.

#### 1.6 The Northwestern Research Team

One of the potentially valuable spin off products of this study has been the emergence of a team of R&D system researchers with significant interest in and commitment to the law enforcement field. Members of our group have had many years of experience working in R&D management and systems studies in the commercial sector, national aerospace programs, and the military, health and education contexts, and this background provided a very valuable basis for our present work in law enforcement. But the experience gained in law enforcement this past year has led to a number of our group indicating a particular interest in this sector and a desire to continue to work in this field. There are important and exciting opportunities emerging in this area and in the Northwestern group we believe there is the skill and motivation to make a significant improvement to upgrading law enforcement R&D systems.

Northwestern University is one of the few national centers for research on R&D systems. There is a critical mass of effort here that is difficult to match anywhere. This team is supplemented by a network of colleagues (many of them former students) at universities across the country and even around the world. The team which worked directly on this study consisted of seven faculty members (Radnor and Block of Northwestern University, Young of I.I.T., Connolly of Georgia Tech., Inzerilli of the University of Pennsylvania, Schermerhorn of Tulane and Tansik of the University of Arizona), five other post doctoral level people (Bean and Roessner of the National Science Foundation, Adler of George Washington University, Dolenga of the U.S. Navy, and Hofler of Northwestern) plus a number of graduate assistants (Buckley, Carlsen, Rosner, Shepard, Rosenthal and others). See figure 7 for a list of the research staff that worked on the study. No less important is the fact that along side of this study are many other studies that are being pursued at Northwestern in the R&D area. Four more faculty members (Rubenstein, Thompson, Rath and Zaltman) and more than another dozen graduate students are engaged in such studies on campus and in cooperation with many more researchers in our extended network.

A very important institutional mechanism that acts to integrate the various research efforts at Northwestern in the R&D and science and technology areas is The Center for Interdisciplinary Studies of Science and Technology. This is a university wide institution that

FIGURE 3 RESEARCH STAFF

Team at Northwestern

Senior Staff

Dr. Michael Radnor  
Principal Investigator  
Northwestern University  
Professor, Chairman  
Organization Behavior Dept.  
Director for the Center for  
the Interdisciplinary Study of  
Science and Technology

Dr. Myron Block  
Assistant Professor  
Organization Behavior

Dr. Earl Young  
Associate Professor  
Illinois Institute of Technology

Research Assistants

Dr. Durward Hofler  
Senior Researcher

Ray Buckley  
Graduate Assistant  
Organization Behavior

Dorothy Carlsen  
Graduate Assistant  
Organization Behavior

William Rosner  
Graduate Assistant  
Organization Behavior

Charles Shepard  
Graduate Assistant  
Organization Behavior

Heidi Usinger  
Graduate Assistant  
Organization Behavior

Nancy Bloch  
Research Aide  
Pitzer College

At Other Universities

Dr. Terence Connolly  
Associate Professor  
Georgia Institute of Technology

Dr. Giorgio Inzerilli  
Assistant Professor  
University of Pennsylvania

Dr. John Schermerhorn  
Associate Professor  
Tulane University

Dr. David Tansik  
Associate Professor  
University of Arizona

Ronald Goldstein  
Research Aide  
Columbia University

Bonnie Hofman  
Research Aide  
University of Michigan

Susan Kreuger  
Research Aide

Glennys Ulschak  
Research Aide

Rachel Wasserman  
Research Aide

Figure 3 (continued)

Field Interviewers

Dr. Martin Adler  
George Washington University

Sandra Bean  
American University

Lou Chester  
University of Arizona

David Gorra  
University of Pennsylvania

Jac Heiss  
University of Arizona

Dennis Kelly  
University of Pennsylvania

Kenneth Krefft  
Tulane University

Jerry Marlow  
New York University

Paul Rosenberg  
New York University

Richard Rosenthal  
Georgia Institute of Technology

Carl Schwartz  
University of Arizona

General Consultants

Dr. Alden Bean  
Senior Associate  
National Science Foundation

Dr. Harold Dolenga  
Captain, U.S. Navy

Dr. David Roessner  
Research Associate  
National Science Foundation

acts not only to give cohesion to the various studies but exposes the research of individual projects to the contributions and critical evaluation of leading faculty from many disciplines (economics, sociology, political science, psychology, history, etc.) The principal investigator of this study (Dr. Radnor) is the Director of this Center.

It is also pertinent to note the location at Northwestern University of the Traffic Institute, perhaps the leading law enforcement training institute in the country. We have maintained excellent relations with the Institute and were able to gather considerable data through them in a very efficient manner. Given our recommendation that NILECJ carry out work in the training area this relation will be even more valuable than it has been to date. Another important resource at Northwestern is the Transportation Library with its extensive holdings in the law enforcement area.

#### 1.7 Summary and Outline of Balance of Report

Our 1974 Study developed a roadmap of the R&D system for law enforcement equipment based on findings of a field study at some 250 organizations spanning the user, supply and support dimensions. The study was based largely on an examination of eight key issues and ten law enforcement products. The findings enable us to develop an overall model of the R&D system (indicating the requirements and opportunities for federal intervention), to identify key issues at each stage of the system, and hence to provide NILECJ with an evaluation of its present programs with an enumeration of policy options and with a methodology for program and project selection and evaluation.

We believe that a great deal has been achieved in just over one year with a relatively modest NILECJ expenditure (under \$100,000). Critical R&D system issues have been defined, a data base laid down and directions pointed for productive future work. The perspective developed by the systematic approach of our research has provided a firm basis for policy formulation to deal with the central real world issues for law enforcement systems and equipment. This perspective recognized that Federal government is involved in the whole system of need identification, R&D, manufacturing, marketing distribution and testing information dissemination, implementation, evaluation and feedback -- and not just product innovation. The perspective so gained has led us to severely question the direction and priorities of the present ESIP program. We strongly recommend that our thinking, directly or indirectly, be introduced into on-going discussions of the future of ATD's ESIP effort. A less visible but very important spin off product of our research effort this past year has been the emergence of a research team, already experienced in R&D systems but now committed to and significantly exposed to the law enforcement field.

We have been conducting and are proposing appropriate research that exposes and investigates the key issues which determine the strategy and success of an equipment development and utilization program. We have provided guidelines and recommendations for specific present and on-going decisions that NILECJ must make in this area. But such research output and decision guidelines, whether provided by Northwestern or by any other qualified source, is unlikely to achieve its full impact unless two conditions are extant. First there must be a recognition at NILECJ that



there is a requirement that the knowledge so created is vital for policy makers and program monitors. This implies that there be a continuity of such an investigative process to be carried out by both in-house and proper external sources. Such research is as useful as the commitment to benefit from the results of such studies when this is merited. This leads to the second requirement, the existence of a sufficient in-house capability at NILECJ. We recognize the constraints of federal agencies in adding personnel slots. But a great deal can still be effected by technology transfer to present personnel. This can be best achieved by their active participation, in a cooperative mode, in studies of the type we have carried out and are proposing and from targetted education programs.

Volume II of this report describes in more detail the thinking, research design, findings and implications that emerged from our study.

Volume III elaborates on our recommendations for future work that we believe NILECJ should be undertaking.

Volume IV - the appendices, contain the research instruments used in our study.

**END**