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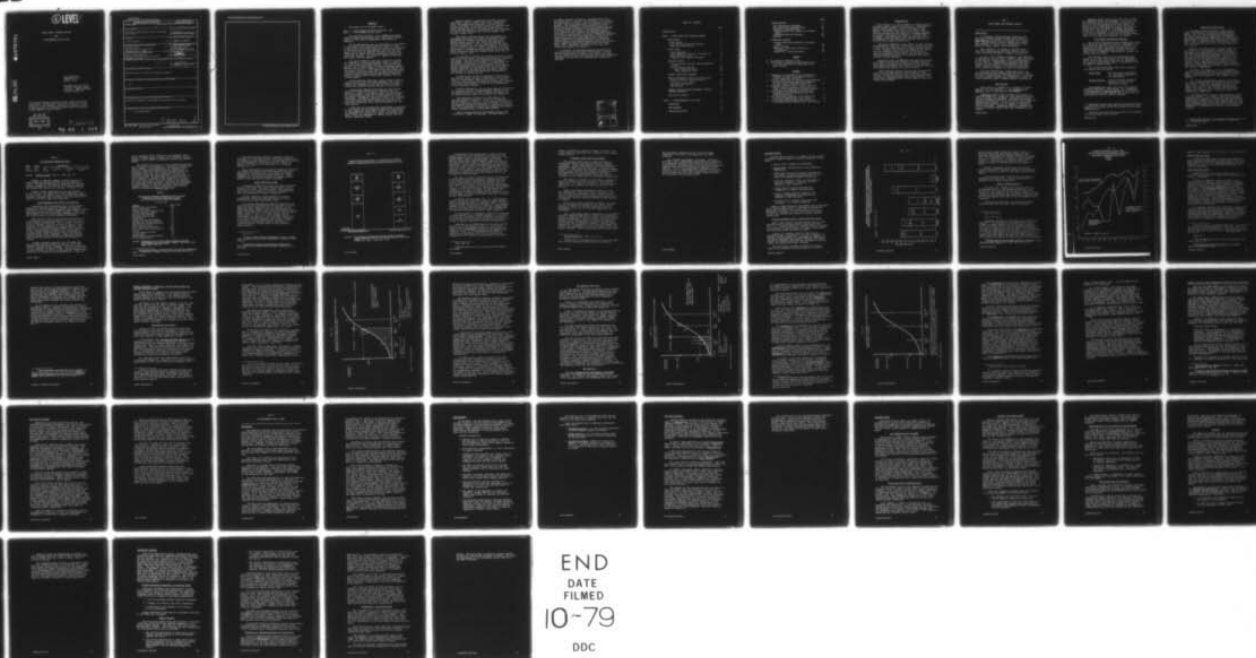
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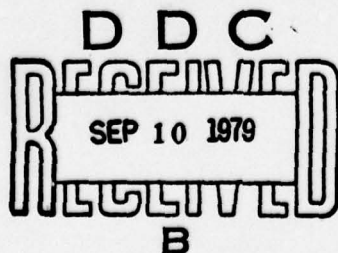
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Washington, D.C.
August, 1978

Prepared for the Office
of Naval Research under
Contract N00014-77-C-0193
Project Number 434

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	--	--
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED
First Money, Venture Capital and A Procurement Policy Idea		Technical rept.
		6. PERFORMING ORG. REPORT NUMBER
		--
7. AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)	
DGS Associates	N00014-77-C-0193	
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
DGS Associates 1629 K Street N.W., Suite 800 Washington, D.C. 20006		62760N, RF 53-511 RF 53-501-001/ NR 365-025
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE
Office of Naval Research Operations Research Program (Code 434) Arlington, VA 22217		Aug 1978
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		13. NUMBER OF PAGES
(12) 59 p.		51
		15. SECURITY CLASS. (of this report)
		Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
		n/a
16. DISTRIBUTION STATEMENT (of this Report)		
Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
n/a		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
Acquisition; Research & Development; Procurement Policy; Benefits		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
See attached pages.		

393 756

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S/N 0102-LF-014-6601

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1. REPORT NUMBER	2. SECURITY CLASSIFICATION
3. TITLE (and Subtitle)	4. AUTHOR
5. PERFORMING ORGANIZATION NAME(s)	6. PERFORMING ORGANIZATION REPORT NUMBER
7. AUTHORING ORGANIZATION NAME(s)	8. PERFORMING ORGANIZATION ADDRESS
9. PERFORMING ORGANIZATION CITY	10. PERFORMING ORGANIZATION STATE
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99. PERFORMING ORGANIZATION COUNTRY	100. PERFORMING ORGANIZATION POSTAL CODE

Abstract

The report is in two major parts:

Part 1 - First Money and Venture Capital, and
Part 2 - A Procurement Policy Idea.

The objective of Part 1 is to assemble available venture capital and R&D data into a form which is meaningful to the private entrepreneur and analyze the findings.

The entrepreneuring firm or individual is interested in risk capital, not solely venture capital or R&D. In particular, such individuals and firms are interested in two main parts of risk capital, the part they must supply by the use of internal resources, and the part which must be sought from and supplied by outside non-associated sources. The former is labeled First Money, the latter, Venture Capital.

The small technical firm has a difficult problem (as compared to larger established firms) in start-up of a new technical product venture. Private venture capitalists are more likely to provide outside support during a small firm's second or third stage growth than for initial start-up. This means that the unaffiliated individual or newly formed firm is faced with net-worth reduction before sales provide operating revenue and outside sponsors show interest and, perhaps, finance further growth.

Large technical firms may, within limits, mark-up product prices with first money expenses, but price-competitive suppliers of any size are less inclined to venture new products through the use of first money.

Established federal contractors may mark-up the prices of current contracts for federal goods and services by about 4% of federal sales and thus prepare for future federal needs and propose venture capital sponsorship through the use of the federal R&D contract instrument. Nonfederal suppliers of any size, unaffiliated individuals and small technology firms must use equivalent commercial first money instruments for the same purpose.

About 90% of all industrial first money is incurred by the largest 624 firms and the amounts are recovered in both commercial and federal sales. For these firms, an estimated \$1.4 billion of a total \$18 billion first money (1977) was recovered in federal sales, the rest through commercial sales.

Venture capital is supplied by several financial instruments; stocks, bonds, trade debt, commercial loans, and federal R&D contracts. Private venture capital available to the small technical firms has been in serious decline since the start of the 1970's. Public venture capital is distributed by the instruments of federal R&D contracts and in-house budgets (\$19 billion, fiscal 1975).

Most public venture capital was distributed to non-market performers that are not measured in their performance by economic standards; stock and bond market prices, profits, ROI, and other measures of economic performance. This is particularly the case for the earliest and most creative phase of innovation where a ratio of over 2:1 favors non-market vs. market performers in government venture capital distributions. Small technical firms were awarded about 4% of the \$19 billion total in 1975.

Two innovation markets are created by national needs, goals, and priorities; innovations consumed by a sponsoring agency, and innovations consumed by nonfederal purchasers. Because the consumer is a monopsonist for the former and multiple and diverse for the latter, federal administrative law and procedure which governs private and public relationships for one innovation market cannot be the same as for the other. However, recognition of innovation marketplace differences is not evident in federal policy.

A brief review of DoD's evolution of first money and venture capital policy is presented, from the early 1960's to the present (OMB Circular A-109). The key finding is that policy evolution has consistently reduced first money requirements to qualify for participation in DoD innovation markets.

Certain features of the U.S. tax code are identified as inhibiting private entrepreneurship generally, and are features which will tend to defeat the objectives of federal mission agency first money cost reductions.

The conclusion of Part 1 is that several U.S. policies uniquely combine to result in an unwritten and unofficial U.S. policy. It is this net policy which fosters inequitable distributions of federal innovation entitlements throughout the nation's innovative resource, and, as a consequence, fosters the formation of economic supply concentrations in the private sector.

Part 2 conceptualizes a procurement policy idea to partially remedy the problem. Its main thrust is

to remove implicit or explicit considerations of an innovating unit's "wealth" (or net-worth) as a criteria for qualification to participate in federal innovation markets. The conceptualization suggests that pre-qualification be based on industrial standards for the hiring of creative scientific and technical personnel. A pre-qualified individual or entrepreneuring unit would receive direct payments for proposal submittals, solicited or unsolicited, to provide nonfederal suppliers of any size with equal entitlements to those found in IR&D/B&P accounts of established federal suppliers. Other aspects of the conceptualization are directed towards equally distributing federal innovation entitlements among pre-qualified unaffiliated individuals, small firms, nonfederal suppliers of any size, and established federal contractors.

In essence, the conceptualization advocates pre-qualifying and providing equal entitlements to those who may successfully innovate in the future and eliminating current criteria and benefits which give unbalanced advantage to those who have successfully innovated in the past.

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INTRODUCTION

→ This report is a first attempt to combine publicly available venture capital and R&D data. Unfortunately, venture capital reports include some costs of new product development which are not included in R&D reports. Thus such costs cannot be directly compared even though they are both applied to a common purpose, to explore and develop new products, services, and processes. More meaningful data and analysis would be a consequence if all new product capital were to be reported using common ground rules.

The thesis advanced in this report is that private entrepreneuring firms and individuals are more interested in risk capital than they are in either venture capital or R&D. Further, they explicitly separate risk capital into two component parts; the part which must be internally-supplied, First Money, and the part which must be externally-supplied by non-associated outside sources, Venture Capital. ↗

Because of data incomparabilities and difficulties, no in-depth analysis was possible of federal policies which have a net effect of distributing risk capital entitlements throughout the nation's innovative resource. Only some broad implications could be drawn.

While reported absolute amounts may be questioned as to accuracy when placed in the context of risk capital, we believe the data have sufficient substance on which to draw preliminary policy conclusions. The second part conceptualizes a policy remedy to what was found and concluded.

PART 1

FIRST MONEY AND VENTURE CAPITAL

DEFINITIONS

A "catalyst" which motivates effective and efficient communications between participants is risk-capital; the sponsor, to protect his investment; the innovator, to gain rewards for success; the consumer, to arrive at an introduction which meets his needs, goals, and constraints.

Risk capital is a financial resource which pays both operating and facility capital costs as a new innovation proceeds to market introduction.

It is a "risk" capital because at the beginning of innovation, at the idea or concept stage, certainty of meeting the diverse goals of all participants is at its lowest. Unpredictable technical and market events will most always be encountered which may cause a major revision in the direction and goals of an innovation program, or even its termination.

All participants must "adaptively-learn" as uncertainties are encountered and resolved so that all may be benefited by new knowledge as it is gained, and risk capital becomes less financially "risky" as a new innovation nears consumer market introduction.

Risk Capital

Risk capital is defined as a financial resource employed for two purposes: to pay operating and facility costs of new product innovations.

Operating capital pays salaries and benefits of creative scientific, technical, and production people; venture planners and managers; marketing and market research personnel and costs; and other labor-intensive supporting activities. It also pays for purchased services and supplies such as computer services and special materials. Operating capital is expensed as a cost of current product sales and therefore is not taxable.

Facility capital pays acquisition costs of R&D and productive plant and equipment. Such costs are not "written-off" in the tax year such costs are incurred,* but depreciated over their useful life. Facility capital depreciation accounts are cash reserves which are set-aside to purchase new plant equipment in the future.** The amount depreciated in one year according to Internal Revenue Service rules will be expensed in the cost of current product sales of that year, and therefore not taxable.

First Money and Venture Capital

The private entrepreneur must pragmatically treat with operating and facility capital. Equipments and facilities may require an initial cash-outlay, or assumption of debt. Personnel wage and salary and other operating expenses must be competitive and offered over a reasonable time-period to attract and retain creative talent.

The practical question the entrepreneur must answer is how much risk capital can he personally afford and to what extent must that be supplemented by borrowing from friends, family, associates, or by mortgage of current assets?

The private entrepreneur explicitly separates risk capital into two parts:

First Money: the risk capital personally (or internally) supplied by the entrepreneur

Venture Capital: the risk capital externally supplied by outside non-associated sources.

First money may supply the total risk capital needed to introduce a new product, or a combination of first money and venture capital may be required. First money and venture capital may be spent for both operating and facility capital purposes.

*Government, however, does expense its own facility capital expenditures in the year incurred in conformance with the federal budgeting process.

**Inflation has caused such cash set-asides to be inadequate for future purchases of new facilities.

Some Data Difficulties

Government mission agencies, large technical firms, the Financial Accounting Standards Board (FASB), the U.S. Cost Accounting Standards Board, the Census Bureau of the Department of Commerce, the Securities Exchange Commission, and the Internal Revenue Service use the term "research and development" (R&D) to identify direct and indirect scientific and technical labor costs, a major portion of risk capital.

However, the definitional context of R&D does not include all the financial elements needed to introduce a new innovation into its target market. The FASB R&D accounting procedures are followed in SEC 10-k industrial R&D reporting.¹ But the costs of several activities required to innovate a new product are not included in FASB ground rules, but are included in the definitional context of risk capital. These FASB omissions are market research, capitalized R&D plant and equipment, product testing, and computer programming.

The SEC's 10-k report, is, as a consequence, silent on industrial R&D plant and equipment investments, venture planning, and some support activities--amounts which are included in the concept of risk capital.

But private entrepreneurs require risk capital, not solely expensed R&D, to perform the total innovative process. Official government reports do not report risk capital, but variously and partially report the costs of labor-intensive R&D activities (direct and overhead costs, excluding General and Administrative mark-ups).

The definitional context of R&D apparently varies within government. For example, Securities Exchange Commission 10-k reports of industrial R&D expenditures includes R&D spending by foreign subsidiaries, but the Census Bureau survey covers only domestic expenditures. This difference alone can account for as much as a 25% difference in reporting for a third of the companies covered.

¹R&D Spending Patterns for 600 Companies, Business Week, July 3, 1978, pgs. 58-59.

Also, an entrepreneur is more interested in risk capital to carry his innovation to a critical design review point than in the "kind" of technical work which is to be performed; applied research, exploratory development, advanced development, and final development. He will organize his program according to preliminary, engineering, pre-production, and production design review points and be less concerned about the "kind" of technical work needed within each transition phase. Indeed, applied research "kinds" of activities may be found in late design phases.

Publicly reported data, however, is organized according to "kind" rather than according to "design."

Analysis of official government R&D data, therefore, will contain source data errors when used in the context of risk capital analyses. When used in analysis, such data will be generally understated as to true risk capital costs.

With these caveats in mind, the following First Money data is from the latest industrial R&D survey reported by Business Week. Security Exchange Commission 10-k reports were used by Business Week in compiling industrial R&D on a company-by-company basis. The survey was limited to companies of over \$25 million annual sales and of those companies, R&D expenses which amounted to more than 1% of sales.

The section which follows First Money describes current knowledge about Venture Capital, externally supplied risk capital.

FIRST MONEY

Some firms may afford the total cost of an innovation by obligation of first money internal resources and not require outside venture capital to complete the innovative process. Whether or not the total cost of an innovation may be internally-afforded depends on scale of resources required and the assessed risk of their recovery through current and expected product sales. For example, the first money scale and risk to fully innovate a supersonic transport was considered beyond the means of any one company. For this reason, in addition to national security reasons, the commercialization of nuclear technologies was also judged unaffordable by any one company. Outside financial support was required in both cases.

Small firms or entrepreneuring individuals may often afford little more than the costs to conceive an idea and communicate it to outside venture capitalists. Their problem may have more to do with decisions about acceptable net-worth reduction to pay first money costs than the risk of cost-recovery through current product sales.

Large Companies

Large companies with established product lines may sometimes mark-up their product prices by a first money expense. The common term for such an expense is "research and development." As pointed out in Definitions, the concept of R&D is not the same as first money even though R&D is a major part of first money. For this reason the data which follows is generally understated as to an accurate representation of large company first money expenses.

Business Week reports that 624 companies (of over \$25 million annual sales) spent \$18 billion for privately-sponsored R&D activities in 1977. These expenses were recovered on commercial and government sales of \$971 billion. What Business Week does not report is that of the \$18 billion reported as privately-sponsored, an estimated \$1.4 billion was recovered on sales to government (IR&D/B&P cost-recovery of about 2% on industry sales to government of \$70 billion). Thus, an estimated \$16.6 billion was more likely recovered on commercial sales than the \$18 billion reported, and about \$1.4 billion independent R&D expense was taxpayer-supplied and not supplied by private consumers of the companies commercial products or services.

TABLE 1

All-Industry Composite Data

<u>Sales</u>	<u>Profit</u>	<u>R&D Expense</u>			
		<u>\$(M)</u>	<u>% of Sales</u>	<u>% of Profit</u>	<u>\$ per Employee</u>
971,562	52,132	18,048	1.9	34.6	1,240

Source: Business Week, July 3, 1978, pg. 77.

Amdahl, a computer company of \$189 million 1977 sales, expensed the most R&D dollars per employee, \$8,679; and Systems Engineering Laboratories, another computer company of \$31 million 1977 sales, expensed the highest R&D dollars as a percent of sales, 12.1%.

General Motors expensed the most R&D dollars, \$1,451 million, but some other large companies, such as Mobil Corp. and Tenneco, did not report R&D expenses, presumably because their expenses were less than 1% of sales, a cut-off in SEC 10-k reporting.

Large Companies and Price Inelasticity

Companies which dominantly supply price elastic markets are less motivated to perform new product innovation on first money resources than companies which dominantly supply price inelastic markets. Thus, one would expect to find first money expenses mainly within the cost-of-sales of price inelastic suppliers.

This relative lack of new product motivation is a consequence of price competition within the firm's price elastic marketplace. That is, when a product's price is reduced, the firm's sales volume will likely increase, or the converse will likely happen. The addition of nonproductive R&D expense to a product's price, holding profit constant, will likely result in a sales volume reduction and overall profitability objectives not likely achieved. Thus, with profit-related objectives in command of corporate strategy, less motivation exists to venture new products for the future.

A price inelastic supplier, on the other hand, may increase product prices by addition of an R&D expense, holding profit constant, with only a marginal (or no) decrease in sales volume. Such firms may mark-up their product prices by an R&D expense because their sales are not generally price-competitive. They may

offer consumers unique technical and management capability, or they may be a member of an economic oligopoly wherein a small number of suppliers control the sellers market.

No standard definition of price inelastic suppliers can be found in the literature. Industry concentration data, however, is accumulated by the Bureau of the Census.² Arbitrarily defining price inelasticity to be present when over 50% of total industry sales are supplied by four (or less) suppliers, we find the following industries characterized as concentrated and price inelastic. Because these industries are also R&D intensive, firms not in the controlling oligopoly may also supply price inelastic products and services by marketing unique technical capability and management. We would expect to find most privately-sponsored R&D expense incurred by these industries, and, in fact, this is confirmed by Business Week data.

TABLE 2

R&D-Intensive Industries Dominated by Four (or less)
Suppliers of Relatively High Sales Volume
 (Over \$1.5 billion total industrial shipments)
 (in billions)

<u>Industry</u>	<u>Sales (1972)</u>
Organic Fibers, Noncellulose	3.6
Soap and Detergents	3.4
Turbines and Turbine Generator Sets	2.2
Internal Combustion Engines	3.3
Ball and Roller Bearings	1.5
Electronic Computing Eqmt.	6.4
Transformers	1.5
Household Refrig. and Freezers	1.7
Telephone and Telegraph Apparatus	4.5
Semiconductors and Related Devices	2.7
Engine Electrical Eqmt.	2.0
Motor Vehicles and Car Bodies	42.9
Motor Vehicle Parts and Accessories	18.3
Aircraft	8.8
Aircraft Engines and Parts	3.6
Railroad Eqmt.	2.5
Guided Missiles and Space Vehicles	4.1
SIC 48, Communication	--

Source: Formulation of an STS (Space Shuttle) Market Development Plan and Sales, (NASA), DGS Associates, Sept. 1977, pg. 21.

²Concentration Ratios in Manufacturing, 1972 Census of Manufacturing, U.S. Department of Commerce, Bureau of the Census, MC72(SR)-2.

Non-concentrated industries (industry sales not dominated by 4 (or less) firms) where price-competition is evident and R&D intensity is low demonstrate relatively low R&D expenses as a percent of sales: Metal and Mining 1.0%, Fuels 0.4%, Containers 1.1%, Building Materials 1.0%.³

Thus, R&D-intensive oligopolies generally characterize industries within which firms are most likely to demonstrate relatively high new product first money expenses for the venturing of new products. These expenses will likely be recovered in current product sales to both private and public consumers.

Small Technical Firms

Information about first money for small technical firms of less than \$25 million annual sales is very difficult to find. One study noted, "data regarding the financing of technical 'start-up' situations and very new companies are almost nonexistent."⁴

Another research study⁵ examined the public prospectuses which were offered during the period 1970-1974 by 31 small technology firms.

The Securities Exchange Commission requires that three prior-year financial data be included in statements of public offerings and, by analysis of the admittedly small sample, the study demonstrated that small technology firms (under \$5 million capitalization) depend almost totally on outside venture capital for their start-up, Fig. (1). This finding can be interpreted to imply that the individual entrepreneur most likely employed personal first money resources in attempts to gain outside equity capital. There literally are no research data of entrepreneur-incurred personal or firm costs to gain start-up equity capital.

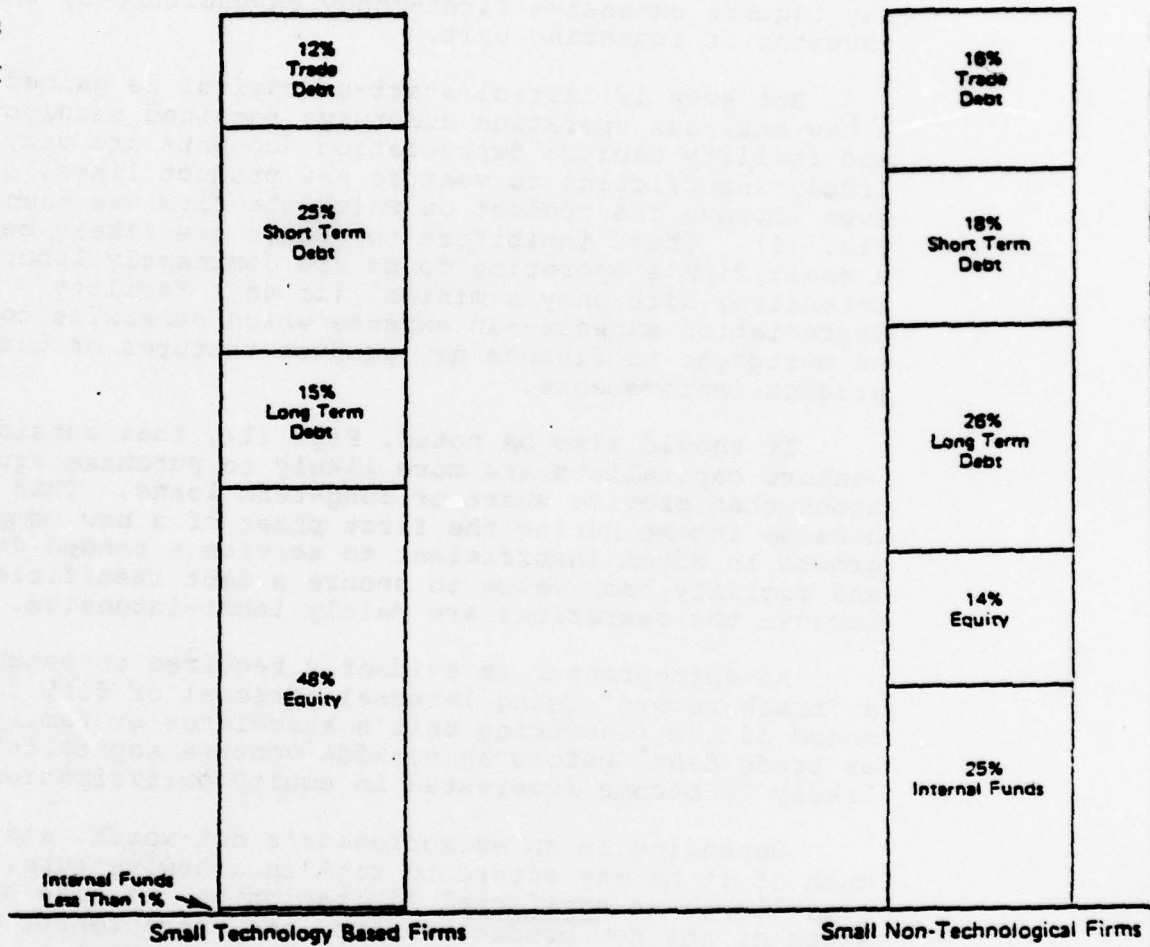
³Op Cit (1).

⁴The Role of New Technical Enterprises in the U.S. Economy, Commerce Technical Advisory Board, Department of Commerce, January 1976, pg. 7.

⁵An Analysis of Venture Capital Market Imperfections, NBS-GCR-CTIP 76-12, Charles Rivers Associates, Cambridge, Mass., Feb. 1976.

Fig. (1)

COMPOSITION OF SOURCES OF ALL FINANCING OF A SAMPLE
OF SMALL FIRMS MAKING INITIAL PUBLIC OFFERINGS 1970-1974



Source: An Analysis of Venture Capital Market Imperfections, NBS-GCR-ETIP 76-12 Charles Rivers Associates, Cambridge, Mass., February, 1976.

Entrepreneur first-money costs to gain start-up equity capital may be significant in relation to the entrepreneuring firm's or individual's net-worth. The report noted, "Most investments made (by private venture capitalists) are not made in start-up, but in the second or third stages of development of portfolio companies...later stage investments are thought to be less risky than start-ups."⁶ This suggests that initial start-up equity capital, where financial risk is the greatest, is relatively more difficult to come by, and may require extensive first-money expenditure by the inventor or inventing unit.

But even if initial start-up capital is gained and a new business operation underway, retained earnings and facility capital depreciation accounts are very likely insufficient to venture new product lines, or even improve the product on which the firm was founded, Fig. (1). These inhibitors to growth are likely because a small firm's operating costs are dominantly labor-intensive, with only a minimal (if any) facility depreciation expense--an expense which otherwise could be mortgaged to finance new product ventures or current product improvements.

It should also be noted, Fig. (1), that outside venture capitalists are more likely to purchase equity stock than provide short or long-term loans. This is because income during the first phase of a new company's growth is often insufficient to service a bonded debt, and facility book-value to secure a debt insufficient because the operations are mainly labor-intensive.

An entrepreneur is evidently required to establish a "track-record" using internal personal or firm funds, those of the innovating unit's associates or family, or trade debt* before an outside venture capitalist is likely to become interested in equity participation.

Depending on an entrepreneur's net-worth, and how much of it he may afford to risk in a new venture, establishes an artificial limitation on the size and scope of any new product venture the entrepreneur may conceive. That is, an entrepreneur may invent a particularly attractive idea, but if start-up and expansion to the second or third stages of the firm's

⁶ Ibid, page 164.

* Suppliers deliver at no cost, but with future obligation for payment.

growth is beyond the inventor's means, the idea has a low chance of surviving into a second or third stage growth pattern.

A Federal First Money Instrument

New product first money is made available to established federal contractors through a taxpayer instrument. First money expenses may be recovered by established federal contractors as a "cost-of-doing-business." Such costs are recovered on current federal sales. This financial first money instrument is known as Independent R&D, Bid and Proposal (IR&D/B&P). IR&D/B&P is an allowable federal contract expense according to the Armed Services Procurement Regulations.

The amount of industrial first money recovered on federal contracts was \$887 million for the Defense Department's 91 largest contractors. This amounted to about a 4% price mark-up on their DoD sales of 26.5 billion.⁷

These recoverable independent technical costs must demonstrate relevance to DoD's interests. They also include the contractor's cost to make venture capital propositions to DoD venture capitalists which, if supplied, would be supplied through an R&D contract instrument.

Total first money recovered on federal contracts for all government procurement is not known, but an estimate of 2% on \$70 billion industrial sales to government (1975), or \$1.4 billion, appears to be reasonable.*

Thus, established federal contractors are indirectly provided taxpayer-supplied first money to independently create and explore new product ideas, assess the agency consumer marketplace, submit solicited or unsolicited venture capital propositions to federal R&D sponsors. First money may be recovered whether a venture capital proposition is successful or not, although federal contractors may sometimes only partially recover the total amount expended. Unaffiliated individuals, small firms

⁷Congressional Record, S9250, June 5, 1978.

* IR&D/B&P costs are reported as the sum of direct and indirect costs, excluding General and Administrative cost allocation.

and nonfederal suppliers of any size must employ commercial first money instruments for the same purposes.

The IR&D/B&P procurement instrument, therefore, provides a cost reimburseable mechanism and a continuum of independent technical and marketing activities in transitioning the exploration of an idea from internally-supplied first money to externally-supplied venture capital. It is a government-paid instrument which is available only to established contractors, but unavailable to those that may wish to enter federal markets by challenging those already there.

VENTURE CAPITAL

Outside venture capital in support of new product innovation comes by means of several financial instruments:

- equity stock (common and preferred),
- bonded debt (convertible or non-convertible debentures),
- trade debt (outside financial assistance by the supply of services or materials at "no cost" with deferred payment obligation),
- short or long-term loans (if unsecured, in the bond category; if secured, in the commercial loan category),
- direct venture capital contracting (commercial or public R&D contracts),
- grants (reduced sponsor financial and technical engagement and direction as compared to R&D contracts),
- no-cost use of sponsor owned plant and equipment, i.e. facility capital.

Some of these financial instruments may be employed in different combinations to continue an innovation beyond an affordable first money cost, with, as mentioned, a portion of total first money allocated to meet the informational needs of outside venture capitalists.

Private Venture Capital, Small Technical Firms

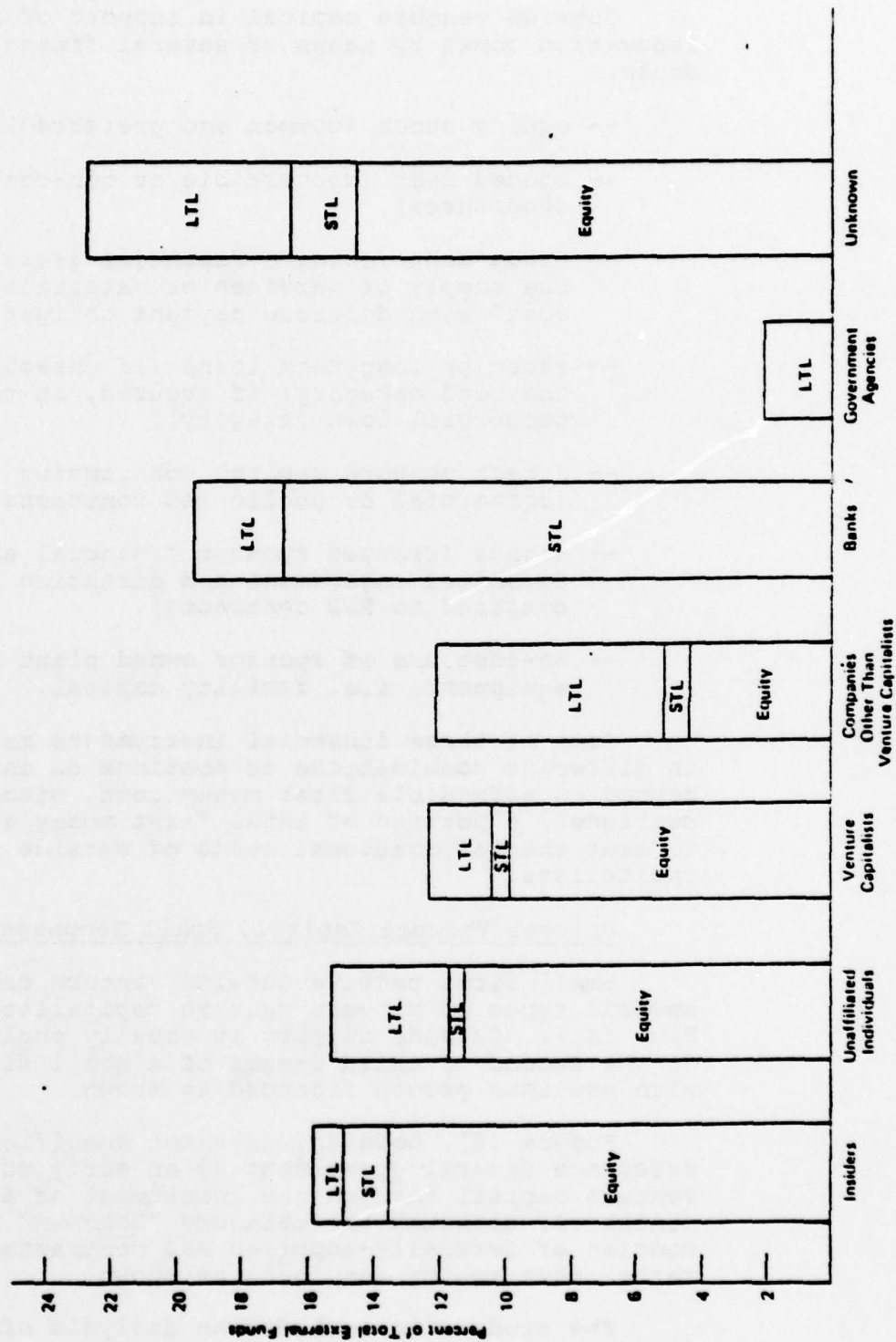
Small firms receive outside venture capital from several types of private venture capitalists (see Fig. (2)). Outside support is usually publicly offered at the second or third stages of a small firms growth with previous growth financed as shown.

Figure (2), however, does not specifically reference federal government as an early supplier of venture capital through the instrument of federal R&D contracts, although the category "Unknown" may mainly consist of federally-supplied R&D contracts or grants, rather than equity and loans as shown.

The study also included an analysis of equity funds to all industry and particularly the flow of

**AVERAGE COMPOSITION OF EXTERNAL FUNDS RECEIVED BY SMALL
TECHNOLOGY BASED FIRMS MAKING INITIAL PUBLIC OFFERINGS 1970-1974**
(Percentage Distribution by Type of Investors)

Source: Same as Fig. (1)



equity funds to small technical firms, Figure (3). The study concluded that equity support to small technical firms paralleled general economic activity, with 0.0-0.5 percent to 2 percent of the total equity flowing to such firms.⁸ In absolute terms, equity stock, as a venture capital resource for small technical firms, was estimated at \$700 million for 1971.

Another independent study found that equity venture capital for the small technical firm declined from \$1.1 billion in 1969 to less than \$16 million by 1974.⁹

Venture capital data, through the instrument of commercial R&D contracts, is not available but is believed to be almost nonexistent.

Public Venture Capital

In fiscal 1975, federal R&D of \$19 billion was distributed mainly to non-market performers;* \$10.4 billion vs. \$8.4 billion to industry.¹⁰ These distributions were directly made to support agency in-house scientific and technical activities and to industry and private non-market operations by the instrument of R&D contracts.

Also during fiscal 1975, non-market performers received more than 100% more "seed" or start-up

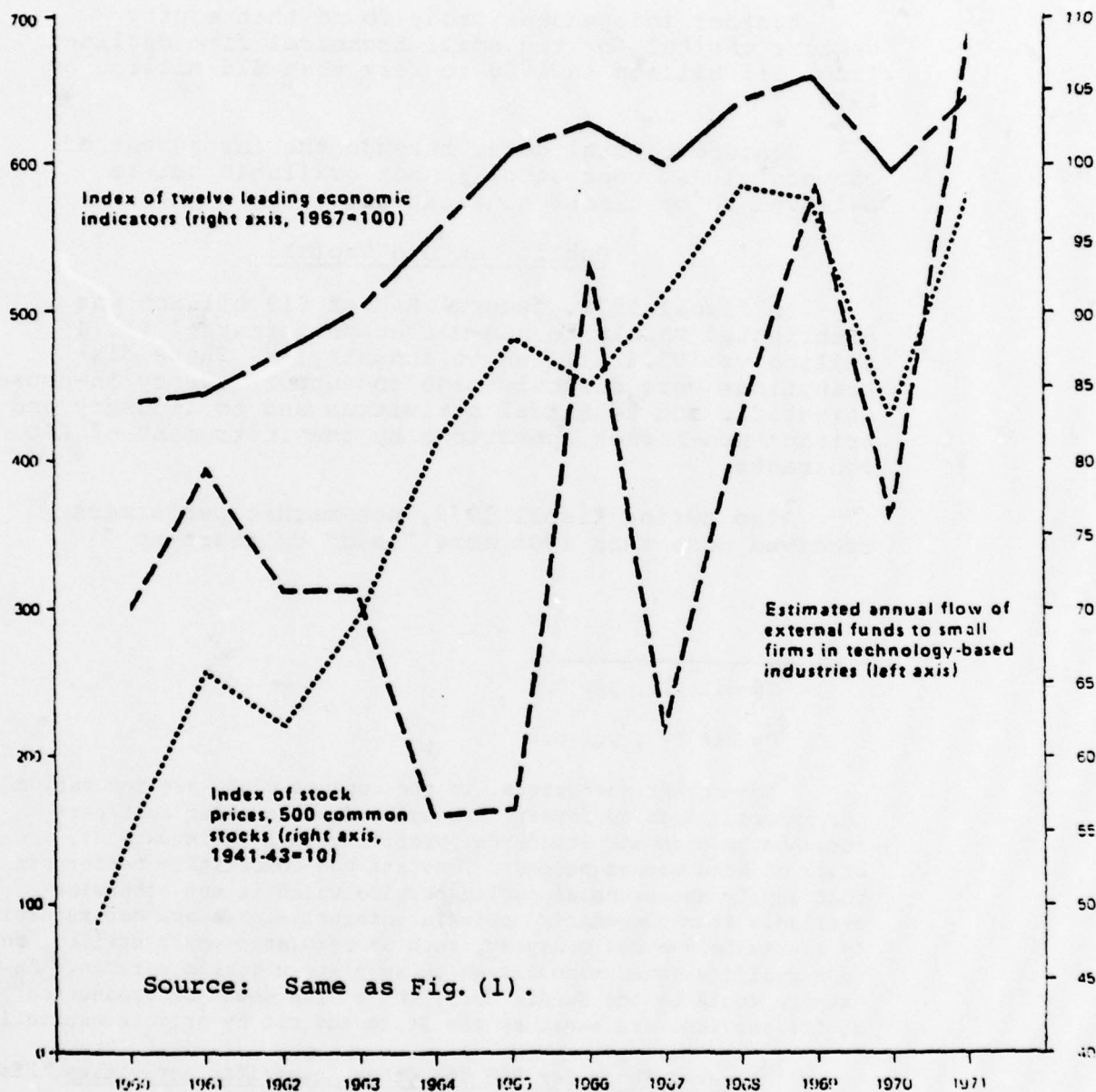
⁸Op Cit (1), pg. 8.

⁹Op Cit (4), pg. 8.

*Non-market performers, in the context used, are innovation performers. Such performers are not judged in their cost/performance by economic standards; profit, return on investment, stock or bond market prices. They are non-competitive performers that supply an essential public service which is not otherwise available from competitive private enterprise. We are not referring to a privately-owned monopoly, such as regulated power utility, but to a publicly owned monopoly which supplies a public service. An example would be the Sandia Corp. where "the means of production" of its services are owned by the State and not by private capitalists.

¹⁰Federal Funds for R&D and Other Scientific Activities, Fiscal Years 1975, 1976, and 1977, Vol. XXXV, NSF 76-315, pg. 1.

Fig. (3)
**ESTIMATED EXTERNAL FLOW OF FUNDS,
 INDEX OF TWELVE LEADING ECONOMIC INDICATORS,
 AND INDEX OF 500 COMMON STOCK PRICES**
 1960-1971
 Annual



capital* than industry; \$3.5 billion vs. \$1.5 billion.¹¹

Small Technical Firms

A survey has been made of federal R&D awarded to small technical firms during fiscal 1975.¹² The study found that of \$19 billion total R&D expenditure, about \$700 million, or 3.7%, was awarded through the R&D contract instrument.

Large Technical Firms

Large technical firms were awarded about \$7.7 billion venture capital in fiscal 1975 through the R&D contract instrument.

However, an observer claims that many of the largest defense companies are more likely non-market operations than profit-motivated companies, and therefore not measured in their performance by economic standards. The Scientific American article¹³ claims, for example, that Lockheed's sole source position for follow-on sea based ballistic missiles, starting from the Polaris and continuing through the Trident, removes profit and cost-reduction motivations which are characteristic of the usual understanding of private competitive industry. Several other examples are cited of government's direct and indirect control over the U.S. economy through the employment of non-market mechanisms and operations.

In presenting federal R&D allocations we have used official R&D data which does not distinguish between corporate behavior and motivational patterns of various federally-financed R&D performers, except as such data distinguishes between stockholder owned private firms and chartered not-for-profit operations, such as in-house agency laboratories, technical centers and

*"Applied research" in government terminology. All terms mean the earliest, most risky application of risk capital (subject to previous caveats about R&D definitions). Also, reports of in-house R&D costs are under-reported by about 16%, OMB Press Release, #15, Nov. 21, 1977.

¹¹Ibid, pg. 1.

¹²Internal Memorandum, Office of Federal Procurement Policy (draft), May 13, 1976.

¹³The Pluralistic Economy of the U.S. by Eli Ginzberg, Scientific American, Dec. 1976.

nationalized laboratories; and noncompetitive private administration and operations of government-owned R&D plant and equipment. The Sandia Corp., Livermore Laboratories and thirty others fit into the latter category. Some not-for-profit operations are also privately owned and operated and do, from time to time, compete for federal sponsorship, but usually not on a price-competitive basis. Other government levels, state and local, also perform or contract R&D activity through a partial use of federal block grants. Such amounts, however, are not reported.

FEDERAL INNOVATION MARKETS

Government has supplied venture capital to private sector contractors to meet national security goals since World War II, and, since the late 1950's, to meet the nation's space science goals. Since the early 1950's, the exploration of commercial nuclear power, however, has been mainly a nationalized scientific and technical effort performed by "captured" national laboratories. Industry has only lately taken an active role in its commercial supply.

Starting in the early 1970's, an increasing share of federal R&D has been applied to the innovation of new civilian products, processes, and services to meet housing, energy, transportation, health, environment, and safety national goals. Approximately one-half of total federal R&D (\$28 billion, FY 1979) is now targeted towards achievement of such goals.

Broadly, two innovation markets are created by national needs, goals, and priorities.

- innovations consumed by federal agencies for their own and unique use
- innovations consumed by nonfederal purchasers responsive to national civil needs, goals, and priorities.

Federal statutes, policies, procedures for the first marketplace cannot be the same for the second. This is because innovation participants for the former are different than those for the latter. That is, innovation creative technical personnel, venture capital sponsors, and ultimate innovation consumers presents an array of combinations for the latter innovation marketplace that bears little correlation to effective and efficient combinations for the former.

Government, as an experienced consumer of innovations for its own and unique use, must separately construct policy for the nonfederal consumer innovation marketplace. This is the challenge facing civil agencies, a difficult challenge because many key personnel are experienced in AEC, DoD, NASA innovation markets where their knowledge is no longer relevant.

About the most that can be said is that DoD, NASA, and AEC (now part of DoE) innovative experience is important generally, but such experience cannot be institutionally applied to civil innovation participants

because they exhibit a wide diversity in goals and priorities, even though achievement of common national civilian goals is a common objective. What is satisfactory for one nonfederal purchaser is likely not satisfactory for another, even though both choices may be responsive to national civil capability goals which are commonly constrained by national social regulations, such as those for health, safety, and environment.

As an example of the necessity for diversity of nonfederal choice, a personal transportation system appropriate for one locality may be entirely unacceptable for another--a single personal transportation choice created by the federal level of government may have little marketability nationally. Commercial and profit-motivated suppliers would rationally be uninterested in participating in such non-market technical activities, because the particular and unique needs of multiple and diverse consumers stands a low chance of being met.¹⁴

¹⁴ Federal Funding of Civilian R&D Volume 1; Summary, A.D. Little, Inc., Wash., D.C., Feb. 1976, pg. 1. and Analysis of Federally-Funded Demonstration Projects Volume 1: Executive Summary, Rand, Santa Monica, CA, April 1976, pages IV, V.

BRIEF DISCUSSION: Evolution of DoD First Money and Venture Capital Policy

First money to prepare for and propose R&D contracts can be significant depending on the design phase at which competition is invited. This section briefly reviews changes to DoD policy which has governed first money since the early 1960's.

The start of a new weapon's design, like all innovations, begins with an idea or design concept about what the new introduction may be in the future. The idea may be accepted by a company's management for first money expenditure to further explore the idea. But because the introduction of a major weapon into DoD inventory most always incurs a long-term financial burden which even the largest suppliers cannot afford, there is a judgmental limit on how far into the innovative process the company may proceed on its own first money internal resources.

Policies of the 1960's

During the 1960's defense suppliers were asked to principally use internal resources* to move Conceptual weapon's design into Engineering Design before direct R&D contract support would be DoD supplied, and then only supplied to the competitive winner.

A July-August 1967 Harvard Business Review article by Martin Meyerson, Martin Corporation, "Price of Admission into the Defense Business" describes accumulative first money to remain qualified and prepare for competition. The article describes in some detail the DoD 1960 time-period policy for acquiring new weapons and, in particular, describes the financial burden placed on contractors to qualify and compete for engineering design and production contracts.

Mr. Meyerson noted that competition would occur in the early phases of a weapon's innovation by periodic sponsorship of R&D "seed" contracts to support DoD's

* Adding to internal first money resources were R&D "seed" contracts. They were periodically and competitively awarded to assist government sponsors refine a procurement specification for a later full-scale engineering competition. Such weapons as the CSA, F-111, F-15, F-14 and several combat ships were introduced using this approach.

development of a full-scale weapons procurement specification. This engineering specification, developed over several years, would be sent to those companies which had kept pace and remained competitive.* DoD would ask companies to propose final engineering, development, test, and production of the weapon described in its solicitation. A company's accumulated first money to keep pace and responsively compete would continue to increase from the conceptual phase of a new weapon and terminate only when a single award winner had been announced. Figure (4) illustrates the accumulative first money to remain competitive until the final competition was held and the winner announced.

The delay of competition until innovation's Engineering phase placed a high financial burden on qualified defense suppliers. Mr. Meyerson concluded, "that it is (was) possible to spend about five years or more and upwards of \$25 million on one or several aircraft programs and still not meet the threshold of minimum success in the military aircraft business." (pg. 4-6), that it took "a company 4.5 years, with 96 senior men employed every month during that period (prior to engineering competition)" (p. 4-12).

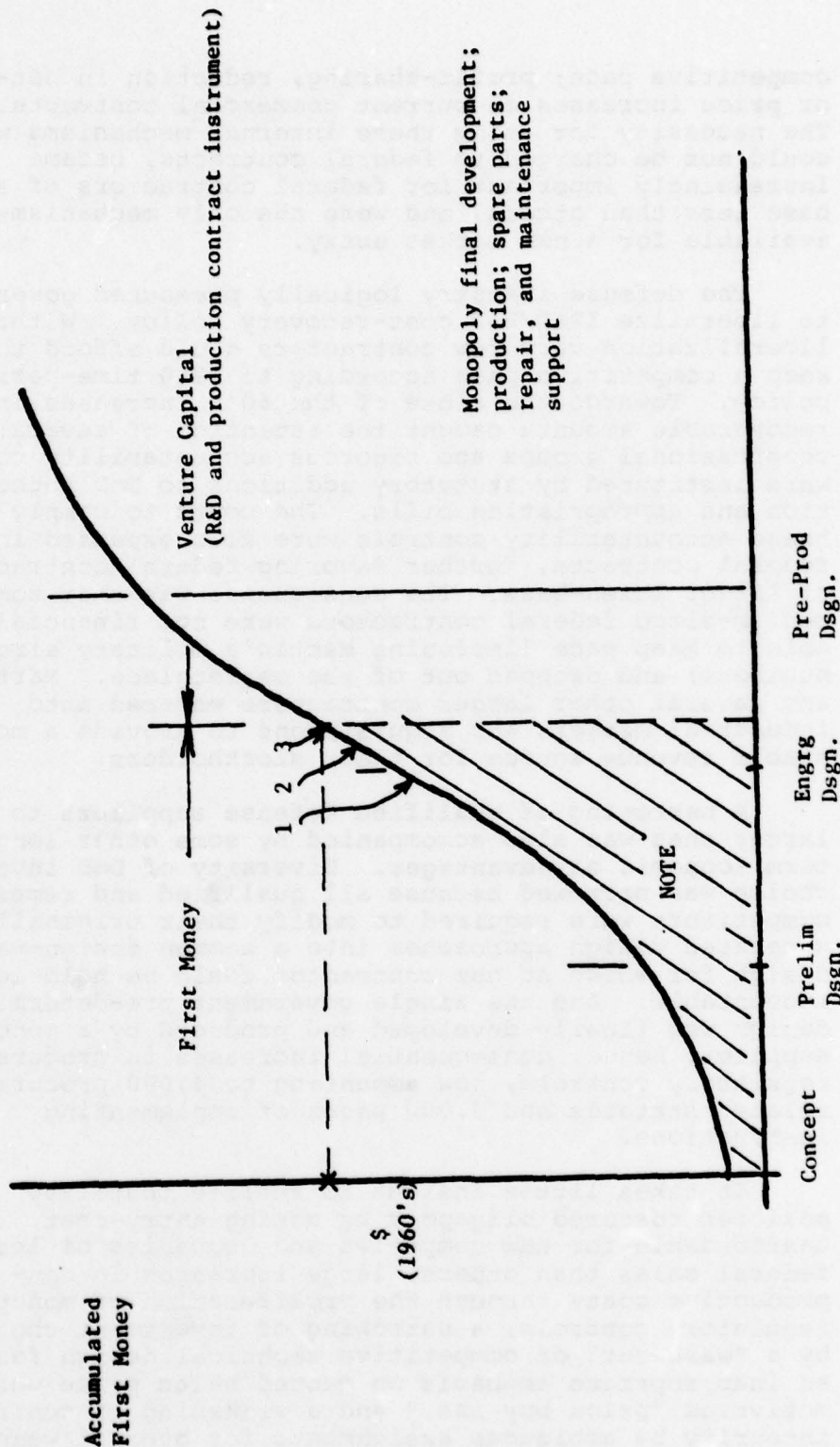
First money was spent to be responsive to government's "demand-pull" designs which were represented by highly detailed engineering-type specifications. However, Mr. Meyerson added an interesting comment about the evolution of "technology-push" ideas; "...systems which are 'invented' by the company take about 7 years and require a company to invest up to 90% for their evolution." (pg. 4-13).

But the "crunch" came when a contractor's federal sales-base was not sufficient to write-off first money expenses on federal contracts. A contractor without a sufficient federal sales-base against which to write-off these charges had to consider the employment of three other internal first money mechanisms to keep a

* It is very important to point out that losers of competitive R&D "seed" contracts had to use internal first money resources, mainly IR&D, to perform the technical activity they had proposed and lost. In effect, they would not "lose," but continue what had been lost on indirect charges to government contracts rather than direct R&D contract charges. This they had to do to remain competitive.

Fig. (4)

THE RELATIONSHIP BETWEEN FIRST MONEY AND ENGINEERING DESIGN
COMPETITIONS; 1960 TIME-PERIOD POLICY



NOTE: Accumulative first money was made-up of:

- R&D "seed" contracts
- IR&D/B&P
- Cost-sharing
- Prorata share of price-mark-ups on commercial products and services in various combinations.

1. Request for proposal
2. Submittal
3. Award Announcement

Source: DGS Associates

competitive pace; profit-sharing, reduction in net-worth, or price increases on current commercial contracts. The necessity for using these internal mechanisms which could not be charged to federal contracts, became increasingly important for federal contractors of sales-base less than others, and were the only mechanisms available for a new market entry.

The defense industry logically pressured government to liberalize IR&D/B&P cost-recovery policy. Without liberalization very few contractors could afford to keep a competitive pace according to 1960 time-period policy. Towards the close of the 60's increases in recoverable amounts caught the attention of several congressional groups and rigorous accountability controls were instituted by statutory additions to DoD authorization and appropriation bills. The costs to comply with these accountability controls were also expensed in federal contracts, further favoring federal contractors of larger sales-base. The consequence was that some medium-sized federal contractors were not financially able to keep pace (including Martin's military aircraft business) and dropped out of the marketplace. Martin and several other larger contractors entered into industrial mergers and acquisitions to provide a more stable revenue source for their stockholders.

A narrowing of qualified defense suppliers to only larger ones was also accompanied by some other long-term economic disadvantages. Diversity of DoD investment choice was narrowed because all qualified and remaining competitors were required to modify their originally separated design approaches into a common design--a design for which no one contractor could be held legally accountable. And the single government pre-determined design was finally developed and produced by a monopoly supplier; hence, consequential increases in procurement regulatory controls, now amounting to 4,000 procurement-related statutes and 3,000 pages of implementing instructions.

It takes little insight to realize that 1960 policies fostered oligopoly by making entry-cost unaffordable for new companies and companies of less federal sales than others, large increases in non-productive costs through the proliferation of monopoly regulatory controls, a narrowing of investment choice by a "wash-out" of competitive technical design features, an inappropriate emphasis on quoted sales price which motivated "price buy ins," and a weakening of contractual integrity by ambiguous assignments for overall weapon's design responsibility.

The Start of the 70's

In 1971 Deputy Secretary of Defense, David Packard, revised 1960 policy. He reinstated competitive prototype competition, an informal effective and efficient policy of the 1950's, by introducing competition at an earlier design phase than the 1960's mandated Engineering Design phase.

Figure (5) illustrates the reduction in first money to qualify and participate in a competitive prototype competition. These competitions were entered at the Preliminary Design phase of innovation.

Again, the cumulative amount is principally made-up of two parts; first money charges to current federal contracts (IR&D/B&P), and direct R&D "seed" contracts. Some profit-sharing, particularly in company support of R&D "seed" contracts, could be chosen by company managements if it was in the company's interests and was affordable.

But even though first money was reduced by the 1971 revision, the IR&D/B&P policy of the 1960's was not changed and, in fact, remains the same today. As with 1960 policy, a relatively large federal contract sales-base still means relatively less demand on commercial mechanisms to pay first money expenses.

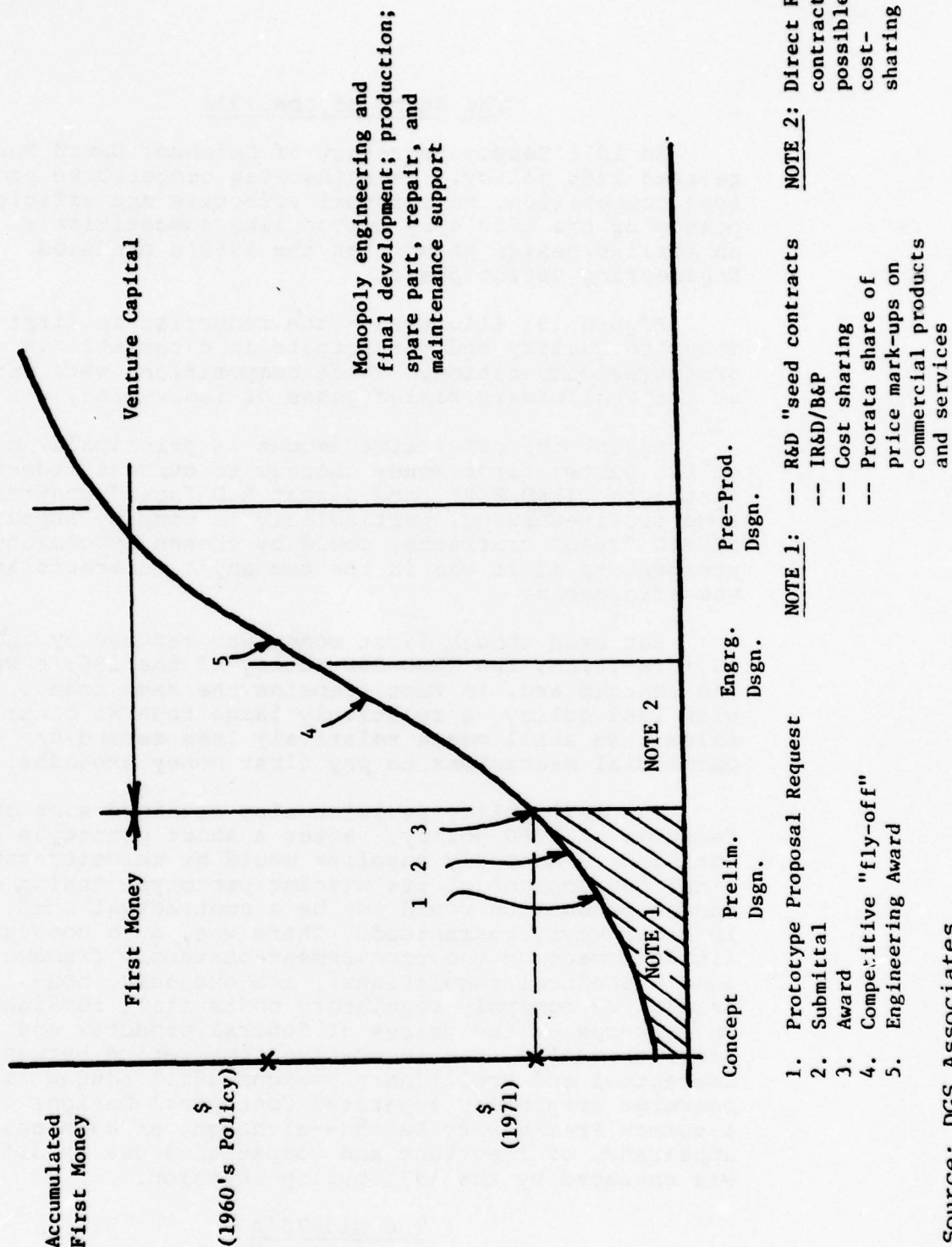
The 1971 policy revision also retained some other features of 1960 policy. After a short prototype competition, a monopoly supplier would be selected for final development of its winning prototype design even though production would not be a contractual item, or, in other ways, guaranteed. There was, as a consequence, little impact on the procurement statutory framework (and procedural regulations), and excessive non-productive monopoly regulatory costs still remained in mark-ups on the prices of federal products and services. Also, the innovative time-period between Conceptual and Preliminary Designs still tended to converge originally separated Conceptual Designs into a common Preliminary Design--although, on balance, the appearance of important and competitive design differences was enhanced by the 1971 policy revision.

The Mid-70's

The U.S. Commission on Government Procurement delivered its report in 1972 to Congress and the President. All federal procurement (about \$50 billion, 1971) was examined and 149 recommendations were made

Fig. (5)

THE RELATIONSHIP BETWEEN FIRST MONEY COST AND PROTOTYPE
COMPETITIONS: 1971 POLICY



Brief Discussion:

for improvements to the efficiency and effectiveness of federal contract expenditures. One section of its four-volume report treated with "Major System Acquisition," (Volume 2, Part C).

Much has been written and said about the Commission's "system" report which will not be repeated in detail here. The important change recommended by the Commission was that competitive entry into system's competition be moved still further ahead in the design process, to the Conceptual Design phase. This change and relative impact on first money, is shown on Figure (6).

The intent of the Commission's recommendation was to widen the competitive base by permitting contractors less "wealthy" than others, but otherwise pre-qualified, to equally compete by reduction in required first money expenses and ownership of expensive R&D and production plant and equipment. The work to be performed subsequent to conceptual design is mainly labor, not facility capital intensive, so facility capital "wealth" was to be minimized in pre-qualification criteria.

The Commission's recommendations could be characterized in the following way, "...all pre-qualified private suppliers, regardless of corporate net-worth, federal contract sales-base, or principal business should be permitted to respond to federal mission needs at the idea or concept phase of innovation, enter federal innovation markets based on the federal sponsor's judgmental evaluation of their competitive ideas, and achieve corporate growth during later innovative phases by exhibiting tangible competitive results."

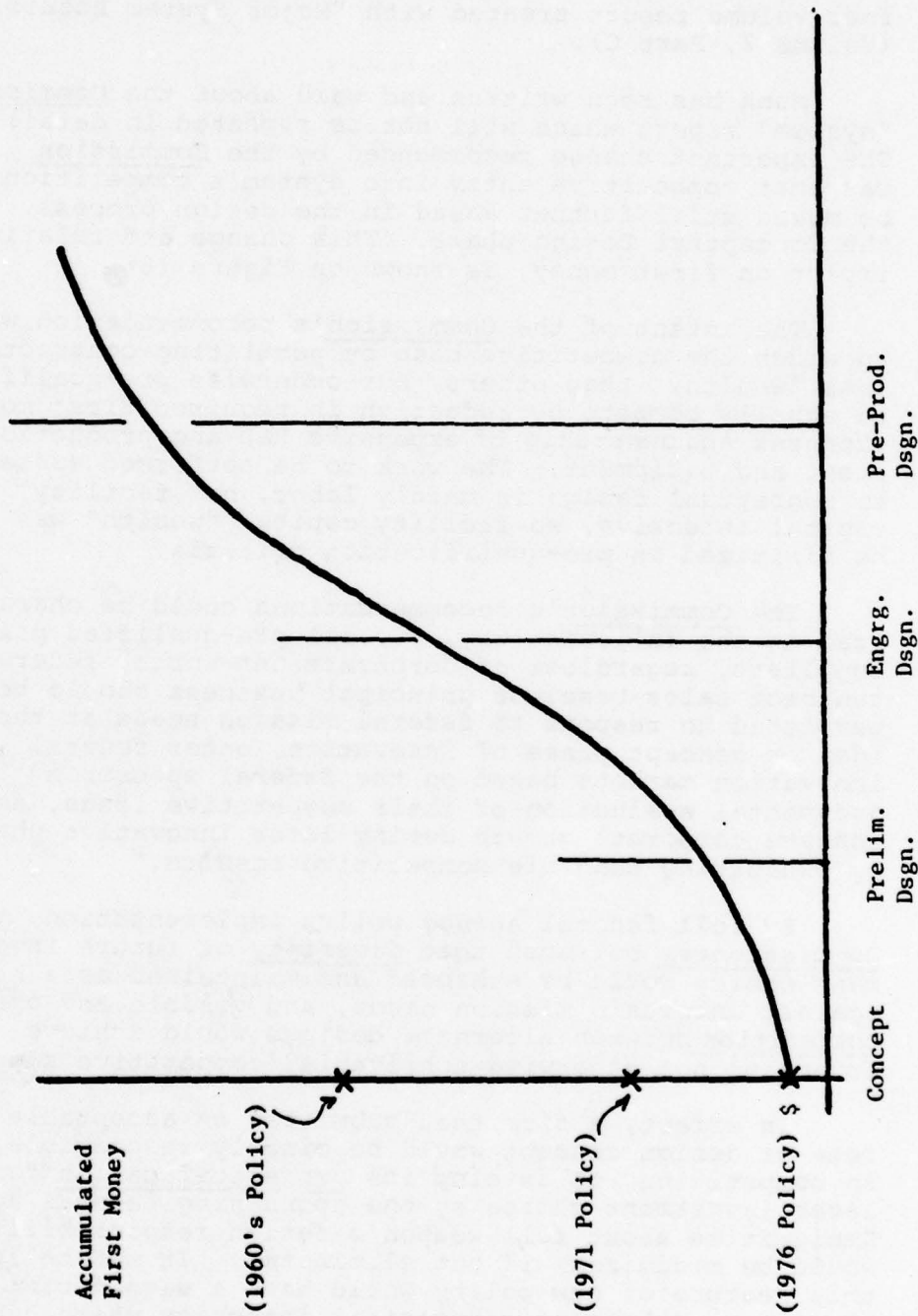
By full federal agency policy implementation, the Commissioners believed that diversity of future investment choice would be enhanced and maintained as a hedge against uncertain mission needs, and visible and open competition between alternate designs would achieve economies not otherwise achievable (competitive supply).

In effect, a firm that submitted an acceptable idea or design concept would be clearly responsible, in competition, to develop its own specification for later investment choice by the sponsoring federal agency. Ambiguities about full-weapon's design responsibility would be minimized, if not eliminated. It was believed this feature of new policy would have a significant bearing on enhancing contractual integrity which had reached a nadir during the 1960's.*

*Shipbuilders build what Navy has designed. This is an extreme case of contractual ambiguity, and makes contractual enforcement difficult for Navy, and motivates shipbuilder's claims against Navy. (Is Navy's design faulty, or did the shipbuilder nonresponsively perform what it had contractually committed?)

Fig. (6)

THE RELATIONSHIP BETWEEN FIRST MONEY AND CONCEPTUAL DESIGN
COMPETITIONS; 1976 POLICY



Transitions through design phases are to be sequentially funded by fixed level commitments, venture capital directly supplied by R&D contracts, and agency investment choice delayed as far through an innovation program as affordable and appropriate to meet operating time-period goals.

Source: DGS Associates

The Commission's intent was for agencies to directly supply venture capital at the idea or design concept phase of innovation as the preferred financial instrument for commencing and continuing alternate and competitive innovative designs, as long as competitive test results and an updated federal need for the innovation program justified continuance. The requirement to employ commercial first money instruments to keep a competitive pace over long time periods would be markedly reduced. Hence, an effective challenge to defense industry oligopolies, which were created by 1960's policy, could become a feature of U.S. policy.

Clearly, previous innovation policies had fostered financial and new business inequities according to a firm's net-worth, federal contract sales-base, and principle business. While not eliminating inequities, the Commission's main thrust was to minimize them.

The Commission's recommendations were conceived within the rule of law to foster the distribution of equitable financial and new business entitlements; regardless of relative net-worth, federal contract sales-base, or the principle business of a pre-qualified inventive/innovative unaffiliated individual or firm.

Within the rule of law, the Commission's recommendations were also referenced to innovation's primary attributes; that is, to attributes which are independent of technologies, scale of resources, time spans from idea to introduction, and the particular constraints, goals, capabilities, and other characteristics of innovation's performers, sponsors, and ultimate consumers. In this sense, the recommendations were not to govern only a particular major innovation, but to govern all major innovations.* The need to "tailor" a particular innovation program to fit within the particular characteristics of a particular innovation's technologies, resource scale, time spans, and participants was recognized.**

The Commission recommendations were adopted by the Executive Branch in April, 1976 (OMB Circular A-109,

* Including Navy's ship acquisition programs.

** A "tailored" innovation program is described by innovation's secondary attributes; sales price, operating cost, performance, and introductory schedules. Each innovation is uniquely separated from others by secondary attributes, but all are the same when referenced to primary attribute.

"Major Systems Acquisition"). All R&D agencies are subject to its provisions.

As a final comment, 1960 policies, and their revision in 1971, required a competitive proposer to evidence full capability to complete the totality of the innovative process by completing development, introducing production items into DoD inventory, and providing appropriate spare parts, repair, and maintenance support as required. Contractors either had to have the required full-run facilities; plant, equipment, and personnel, in place, or demonstrate an acceptable financial and personnel plan to acquire them.

It is generally understood that entry into a prototype competition (Prelim. Dsgn.), or an engineering competition (Engrg. Dsgn.), are at phases of innovation which exhibit an increasing rate of resource expenditure--relatively large expenditures are still to come.

While venture capital and some special facility capital may be government-supplied, several "large-ticket" items usually remained for the company to supply out of its own resources. Pre-qualification at these late innovative phases emphasized capital "wealth" rather than ideas which create capital wealth through successful introduction. It was based more on pre-qualifying those who had successfully innovated in the past, rather than on pre-qualifying those who may successfully innovate in the future.

The new policy opens the possibility of a consortium of small firms to directly challenge larger established firms. The small firm consortium's total internal resources (mainly people) should suffice to demonstrate pre-qualification capability without unaffordable demands on future resource expenditure as a pre-condition for qualification. This is the essence of a policy which fosters ... "corporate growth based on competitive merit," a policy which is supportive to private enterprise, capitalism and a free and democratic society.

FEDERAL POLICIES WHICH GENERALLY INHIBIT PRIVATE VENTURING

Both DoD and NASA depend on the creation of unique and innovative ideas in achievement of national security and space science goals, and both are taking policy and procedural steps to reduce first money requirements for entry into their innovation markets.

But some overall federal policies still tend to inhibit private venturing generally, and are policies over which these agencies have little control. The emergence of newer and smaller businesses through reformation of past DoD/NASA innovation policies will decidedly improve chances for broadening the private innovative supply of ideas for future needs by extending opportunities to smaller businesses and allow such firms to achieve corporate growth based on a continuing competitive merit. These reformations strengthen private enterprise specifically, and capitalism generally.

However, the emergence of new innovative small firms as idea resources for these agencies is generally inhibited by provisions found in the U.S. tax code.

Friedrich Hayek noted:

"The most serious consequence (of the system of taxation)...is the restriction of competition. The system tends generally to favor corporate as against individual savings and particularly to strengthen the position of the established corporations against newcomers. It thus tends to create quasi-monopolistic situations."¹⁵

The tax code drives private venture capital out of the private marketplace into the treasuries of large firms where it is unreachable by unincorporated firms and individuals. The wealthy private capitalist, on whom most private inventors in the past have depended, is fast disappearing.¹⁶

Another major reservoir of venture capital is the U.S. Treasury, as has been pointed out. But individual

¹⁵The Constitution of Liberty, Friedrich A. Hayek, 1960, Henry Regnery and Co., pg. 320.

¹⁶The Role of New Technical Enterprises in the U.S. Economy, Commerce Technical Advisory Board, U.S. Dept. of Commerce, January 1976, pg. 8., see also, Op Cit (5), pg. 227.

and small firm access to this centralization is blocked by 4,000 procurement-related statutes and 3,000 pages of regulatory instructions.*

The net outcome is that unaffiliated individuals and creative and innovative people employed by small firms and nonfederal suppliers are motivated to leave private entrepreneurship and join large firm and government employment.¹⁷ In the long-term this will tend to defeat DoD's and NASA's new policy objectives by fostering economic concentration within high-capital wealth companies.

Another tax-inhibitor to private entrepreneurship is found in unrealistic treatment of venture capital in the U.S. tax code.

The cost of venturing new products is properly considered a "cost-of-doing-business" and therefore not taxable, but tax-deductibility is arrived at in an unrealistic way. Those who have directly participated in new product innovation fully understand that if "seed capital," "start-up money," or "applied research" (in government terminology) cannot be gained very little else will happen. Thus, a new product innovation is stopped before it begins.

"Seed" capital is needed to start new product innovation and is the lowest of all innovation expenditures, but it is also the most financially risky. Market uncertainties combine with new product technical uncertainties at the beginning of innovation to put the highest financial risk on innovation's lowest expenditures.

* It should be noted that established federal contractors are indirectly paid by taxpayers to comply with these administrative complexities and prepare for and propose new agency business.

¹⁷ Characteristics of the National Sample of Scientists and Engineers, 1974 (updated to 1976), Part 2 Employment, NSF 76-323, pg. 149. The two concentrated risk capital sources, government and large corporations, motivates creative entrepreneurs to seek employment with them and, in so doing, further concentrates economic power. But when such people leave private entrepreneuring they are more motivated to join federal than private employment: median salary \$24,900 federal vs. \$23,100 private, without correction for recent top federal salary increase from \$36,000 to \$47,500, plus better benefits, including job security.

But the U.S. tax code equally treats tax deductibility of all innovation expenditures regardless of relative risk of expenditure. This clearly motivates private venture capitalists to delay financial participation to later innovative design phases. It is in later innovative phases where most technical uncertainties will have been encountered and resolved, market data made more precise, and expectation of financial return made more realistic and convincing.¹⁸

The U.S. tax code burdens the private inventor who must pay "seed" money out of his own pocket as outside capital decisions are delayed to relatively expensive late design phases. This artificially limits innovation to only those who may be sufficiently "wealthy" to afford the costs of delay, but individual or corporate wealth of the moment has little to do with the ability to create and explore new product ideas for the future.¹⁹

What is needed is higher tax deductibility of the costs for new product feasibility demonstrations rather than the same deductibility for expenses incurred during later innovative phases. These later phases would include fully engineered prototype demonstrations and pre-production pilot runs. Such changes would motivate corporate and private venture capitalists to put money "up-front" in the innovative process, a motivation which is clearly absent from current tax policy and stops a new product innovation before it even begins.

¹⁸Op Cit (5), pg. 164, "Most investments made (by private venture capitalists) are not made in start-up but in the second or third stage of development of portfolio companies...later stage investments are thought to be less risky than start-ups."

¹⁹Science Indicators, 1976, National Science Board, pg. 11. The 1953-1973 innovation rate measured by major innovations per R&D dollar, strongly favored small firms (of less than 1,000 employment) by 4 times the innovation rate produced by medium-sized firms (1,000 to 10,000), and 24 times the innovation rate produced by large firms (10,000 +). The Board suggested that "larger firms tend to produce minor rather than major innovations, e.g. small improvements that reduce the cost of high throughput manufacturing processes rather than completely novel products."

NET POLICY OUTCOME

Taxation on savings and venture capital, the IR&D/B&P procurement instrument, and lack of application of government's 20-year "make-or-buy" policy to innovative activities combine to foster a net unwritten public policy. This net unwritten public policy fosters inequitable distributions of financial and new business entitlements by favoring large federal contractors and inhibiting new business start-ups and small firm growth. Thus the net public policy fosters the appearance of economic oligopolies within the U.S. economy.

Each policy standing alone produces the public benefits for which the policy was instituted. The IR&D/B&P procurement instrument, for example, has permitted technical and new business independence and has maintained competition for future procurements, as claimed by IR&D/B&P advocates. The system of taxation has redistributed wealth as intended, and by not taxing new product developments, encourages them. Government's dominant allocations of new product start-up capital to non-market operations has provided the agencies with in-depth scientific and technical knowledge so that contractor representations may be professionally assessed and major agency programs professionally managed.

But it is the net public policy caused by their interactions which distributes inequities, according to relative net-worth, federal contract sales base, and principle business. Hence the net policy fosters economic concentrations and oligopoly.

The A-109 "major systems" policy will tend to redress financial and new business inequities in the future by reducing competition pre-qualification requirements to a low-scale and labor-intensive phase of design, thereby reversing the previous need for high first money expenses and down-stream R&D plant and equipment (or financial resources to acquire them) as a competition pre-qualification requirement. This feature of A-109 policy should permit smaller technical firms to equally compete with larger ones at the outset of new product innovation. But A-109 does not apply to "minor" systems or general innovative activities which are usually aggregated under the label of "technology base" activities.

What is needed is a national innovation policy, constrained by the rule of law, and referenced to a framework of innovation's primary attributes.

Such an innovation policy would equally apply to all innovations and all innovation performers regardless of their relative net-worth, federal contract sales-base, or principle business. It would apply equally to any innovator that is pre-qualified on the basis of past innovative experience, recognition among peers as an expert in prescribed areas, public presentations or papers which demonstrate new approaches to national needs. In short, such a policy would remove relative "wealth" as a factor in the distribution of federal financial and new business entitlements. It would apply equally to large firms and small ones.

But the U.S. does not have such a national innovation policy. Because it does not, unaffiliated individuals and small firms do not receive equal financial and new business entitlements as compared to federal contractors, their start-up capital is absorbed mainly by non-market operations, and private capitalists are not motivated by the tax system to provide start-up capital for ideas which may have only a single and uncertain consumer market. Thus, newer and smaller businesses are not encouraged to prepare for and enter federal innovation markets by an unwritten and unofficial net public policy.

Large established federal contractors have significantly contributed to national purpose in the past and will continue to do so in the future. Regardless of how a new innovation program begins, large-scale organizations and resources are very often needed at a later time. Providing equalities will not necessarily reduce this need, but may likely reduce the economic concentrations of current supply, and pave the way for the emergence of large companies which are not known today.

PART 2

A PROCUREMENT POLICY IDEA

BACKGROUND

Tax reforms to equally tax the savings of individuals, nonincorporated firms, and corporations, and provide venture capitalists with a "front-end" financial incentive will generally encourage new product innovation. The dominance of non-market performance of new product start-up activities is a matter of applying a 20-year federal "make-or-buy" policy to new product innovative activities. Reforms in these two areas will greatly invigorate new product innovation generally.

The procurement policy idea discussed in this section is conceived to provide equal financial and new business entitlements to all pre-qualified innovators.

The idea is to directly pay the costs of new business proposals when they are submitted by pre-qualified innovative units.

The idea is neither new or involves complex principles or procedures. And yet direct first money payments may be equated to indirectly recovered first money for the same purposes. The latter instrument is provided current federal contractors, the former is the substance of the idea.

The idea has been explored by at least two agencies. The General Services Administration is statutorily authorized (PL 92-582) to assess the competitive design capabilities of Architectural and Engineering (A&E) firms and select those that are judged capable. A fixed and equal amount of money is directly awarded to those selected for the purpose of preparing an initial design proposal based on GSA functional specifications. Thus the costs of the initial proposal are directly paid. One or more of the submitted designs may then be additionally financed for further competitive engineering studies before a single design is selected for construction.

The Navy also has experience in pre-qualifying firms as capable of system design activities and has directly paid proposal activities. All firms that were interested in solving a common Navy problem, and believed they had a competitive design capability, were invited to submit their qualifications and

the approach for design of an advanced ship's defensive system (SIRCS). Seven qualification proposals were received, and of the seven, three were selected for direct payment of initial and competitive design activities. First money incurred by the firms in proposing qualification information was a small fraction of first money which would have been incurred if the initial proposals had required a conceptual design as a basis for award. The relatively expensive conceptual design activity was, in this instance, directly paid by Navy contracts, and not indirectly incurred by first money charges to current contracts.

Government financial and new business entitlements are limited roughly in proportion to a contractor's federal sales. Those contractors of lesser federal sales may recover proportionately less first money.

This rough proportionality limits smaller contractors to technical and new business activities associated with a proportionately smaller future sales possibility; that is, the limitation preclude smaller firms from directly competing with larger firms for major procurements in the future. The smaller firm is not able to grow to a competitive equivalence.

The A-109 procedure attempts to remedy this "built-in" future business limitation by making first money requirements relatively insensitive to the expected scale of future new business. The intent is that small federal contractors may equally compete with larger ones at the beginnings of innovation, at the idea or concept phase where the contracted work is mainly labor-intensive, and, by continuing competitive merit, permit smaller firms to acquire the R&D and productive plant and equipment needed to qualify for future major procurements. The rough proportionality of first money and current federal sales becomes less of a limitation on future business possibilities, and future competition for procurements of any size becomes more evenly spread among innovative firms, regardless of their comparative net-worths and federal sales at the beginning of innovative activity.

The direct proposal payment idea further extends the A-109 concept by spreading competition over a still wider innovative base. It adds the additional feature of insensitivity to current federal sales of any amount. In short, it is an idea for encouraging and attracting new entries into federal innovation markets by providing equality in federal financial and new business entitlements.

ENTITLEMENTS

To be equal, the procurement policy idea should provide financial and new business entitlements equal to those granted by the IR&D/B&P procurement instrument and other general overhead accounts found in federal contracts. Some federal contractor entitlements which should be embodied in the procurement policy idea are the following:

Federal contractors:

- recover all or some first money to propose new business to federal agencies; thus they are not generally required to employ commercial first money instruments
- have technical independence in their approaches to agency problems
- internally have flexible and "quick reaction" procedures to respond to new business opportunities; thus they are not impeded in organizing a new business technical and proposal activity and may do so rapidly
- are able to recover the cost of "waiting" for R&D contract award decisions and may extend internal work to the point of award decision
- are able to assign scientific and technical people to new business technical and planning activities without prior agency approval
- may use indirect contract charges as a scientific and technical employment leveling mechanism to fill-in the ups and downs of direct R&D contracting
- may permit a new employee to "learn" the business, become familiar with customer needs, participate in several new business proposals
- are provided communication and new business marketing costs in general overhead accounts; some may recover the costs of field marketing operations, technical and venture planning, and market research (the extent of recovery depending on federal sales level).

This partial list of IR&D/B&P and other general overhead entitlements is a minimum list that the substance of the idea should address.

These entitlements may be generally associated with three areas:

- pre-qualification, i.e. who should be permitted a direct proposal payment privilege?
- communications, i.e. how should agency needs, goals, and constraints and private responses be communicated?
- procedural matters, methods of billing and payment, the agency handling of "demand-pull" ideas vs. "technology-push" ideas, extension or termination of the direct proposal payment privilege.

PRE-QUALIFICATION

Industry employs scientific and technical personnel based on expectations of their contributions to company commercial goals. An applicant's hiring chances are improved if background and experience is relevant to the technologies embodied in the company's product lines and marketplace; if the applicant has demonstrated acceptable innovation management capability in the past; has general peer recognition for creative approaches to problems; has published papers which demonstrate scientific, technical or management capabilities and insights.

In short, some applicants are judged more likely than others to contribute to the company's commercial goals. These are the ones that will most likely be hired, and they will be hired based on expectations.

Agency pre-qualification for the privilege of direct proposal payments should be based on identical standards. That is, it should be based on an applicant's background and experience and agency expectations of the applicant's contribution to public goals.

As in the case of industrial employment, some that are selected will not achieve expectations, others will, and a still smaller number may exceed expectations.

In effect, the agency would temporarily "employ" unaffiliated individuals, small firms, and other non-federal suppliers. The agency would provide the start-up financing so that those selected may attempt to enter and be successful in federal innovation markets, and, if they become commercially successful, they would also fulfill the needs of the agency by the introduction of ideas which would otherwise not have been available.

The essence of the pre-qualification procedure is that the agency take the financial risk that its selections will contribute to agency goals, and that the cost for the early exploration of ideas which are proposed and directly paid is well worth the benefits received. The benefits will be mainly centered on the broader base of idea sources which the procedure provides as compared to current practice, and the competitive challenge which is introduced by the procedure to larger established firms, particularly at the earliest, least expensive, and most creative phase of innovation.

The alternative to this pre-qualification procedure is well known. Creative and innovative people must be employed by large firms or federal agencies to improve their chances of gaining start-up financing for the ideas which they create. It is within the treasuries of large firms and government where start-up capital is mainly located and private start-up capital for the ideas of individuals or small firms is almost nonexistent.

COMMUNICATIONS

The agency should convey its needs, goals, and constraints to the national innovative resource to motivate the submittal of pre-qualification information. The agency should adopt equitable communication methods and not "favor" known sources in communications of needs.

The Communication Document

The concept of MENS, Mission Element Need Statement, is embodied in A-109 and is under detailed study by various offices within DoD and other agencies. It is to be the basic document for communicating an agency's innovative needs to private innovative suppliers. It is not to contain pre-determinations of technical approaches or any other internal constraints on the creation of ideas. But it is to contain an interface specification which externally constrains ideas to match the idea to an external and agency-prescribed operating environment.

It is also to contain a "cost goal" based on extrapolation of costs of current products and known R&D initiatives, both having been judged as nonresponsive to future mission capability needs, and, hence, new initiatives are sought. New initiatives are to "cost less" than projected costs for procurement and operations of known products and expected costs of R&D initiatives which have been judged inadequate. Thus, the "cost goal" is based on current knowledge, but is not based on someones perception of what a solution may be "worth" in the future, an approach which implicitly pre-determines the solution.

Major and Minor Communications

The procurement policy idea requires a communication document similar to MENS, but the MENS concept should be extended to all innovative needs of an agency regardless of agency perceptions of the "scale" of responses. For, indeed, with full freedom in response to a MENS-type solicitation, some acceptable ideas may not fit "major" standards even though they have been solicited under "major system" procedures.

This comment is simply a recognition that, in searching for equalities, it is irrational to foster communications where one procedure applies when responses are expected to be "major," but another applies when the responses are expected to be "minor." The identical communication procedure should apply.

Constant and Random Needs

Not all mission needs emanate from one level of a hierarchical organization such as DoD; they may issue from many levels. Whether one level issues a need for innovative introductions depends on demands for new needs from the next higher level in all hierarchically-connected organizations. If no additional capability demands are placed, no demands for innovative ideas are rational at any level. In other words, if status quo were acceptable for the future, why should a price be paid for new introductions?

But there is one exception to this general rule. There is a particular category of constant demands for ideas at all mission levels. These demands converge to a generality. There is always a need for current capabilities to be delivered at less cost. This is a constant and continuing mission need at any level.

The need for additional capabilities over and above those currently delivered comes only when perceptions of the future require new capability introductions --that if new capability is not introduced, it is perceived that there will be unacceptable national consequences. Such predictions may be made within national security or civilian mission areas by analysis of future political, economic, social, and national security environments. Ideas about new and additional capability may then be rationally sought.

Thus, there is always a standing and constant mission need for cost improvements to the delivery of standard capabilities at any mission level, but only random needs for new and additional capability. The latter can only be based on perceptions of the future environment and the perceived inability of current capability to deliver what is needed in the future. When that perception is made on one mission level, demands for innovative introductions are placed on all subsidiary levels.

Thus, two classes of mission needs are inherent in any mission agency at any mission level:

- the constant and continuing need to deliver current mission capability at less cost
- the random need to improve or add capability to a particular mission level based on perceptions of unacceptable national consequences if not delivered.

The first mission need is constant and issued at all hierarchical mission levels. The second may be issued from a particular mission level in response to the next higher level's demand and will appear randomly.

Technology-Push as a Source for Mission Needs

The need for additional capability at any mission level may come from a "technology-push" idea. This is an idea which is independently offered at a particular mission level based on the inventor's perception of need at that level. The idea will not be "demand-pulled" by a formal MENS-type solicitation.

Should the promised additional capability be acquired if the next higher mission level has not demanded it? Why should a price be paid for its introduction if higher levels are apparently satisfied with status quo?

These are the key questions. The answers may take one of two forms:

- additional capability is promised at a cost no greater than the cost for future delivery of current capability
- additional capability is promised as a "hedge" against an unforeseen future. The idea may not have to be produced, but it should be developed.

If either answer is acceptable to higher mission levels a demand will be placed on the idea's exploration and development.

Technology-Push and Monopoly

Such a decision has significant economic overtones depending on subsequent actions. If the development of the technology-push idea is performed under monopoly conditions no effective check-and-balance on the program's cost is possible.

The decision, instead, should set in motion two sequential actions; the first, to construct a MENS-type document for communication to other innovative sources; and the second, to negotiate a sole-source exploratory contract as a reward for the inventor's initiative. Other ideas and concepts in response to the MENS-type communication may then also be selected for competitive

exploration, and thus avoid monopoly development of the initial technology-push idea. The innovation program, after completing those actions, would proceed under normal demand-pull procedures which are specified in A-109. These procedures are generally applicable to the orderly and rational progress of any innovation program of any "scale."

Methods

The MENS-type document must be distributed equitably to the nation's innovative resource and some significant changes must be made in current communication methods.

Federal contractors indirectly charge contracts with the costs of field marketing operations, technical and new business planning operations and customer visits, brochures, models, mock-ups, displays, a "home-base" planning operation, and other new business planning and marketing operations. The amounts recovered as a cost of federal sales again will be roughly proportional to the company's total federal sales.

Federal contractor communication costs are, therefore, generally paid by taxpayers. But taxpayers do not directly or indirectly pay equitable communication costs which are incurred by small technical firms, unaffiliated individuals, and other nonfederal suppliers. Thus, federal communication entitlements are also inequitably distributed throughout the nation's innovative resource.

What is lacking is a federal policy which requires mission agencies to take communications initiative. Instead, the agencies philosophically adopt the posture that it is up to the contractor to take such initiative and that their role is principally to respond with new business opportunity and planning information when asked.

Government's new business communication document, the Commerce Business Daily, is used by mission agencies to announce new business opportunities. But the method has several serious disadvantages which preclude its remedying communication inequities.

- it is doubtful that nonfederal suppliers are even aware of its existence
- it costs too much in terms of value received for the individual or small firm

- it is generally felt even by planners within large federal contractors that a new business announcement is already "locked-in" to some other company that had assisted the agency in the need and approach for the pre-announced procurement.

With regard to the last, large contractors depend almost wholly on their in-company new business operations to detect the emergence of new opportunities and will very often assist agencies in developing the procurement. This work can precede a formal procurement announcement by many months and thus provide "inside" information about emerging new business opportunities which is not generally available to others.

A new and more equitable communication method for agency mission needs is not just required, it is mandatory to reduce or eliminate inequitable communication entitlements which are fostered by current practice.

The suggested communications method is based on the following principles and considerations:

- it is government's responsibility to communicate its needs
- local organizations are decidedly better informed about emerging new businesses within their communities than federal agency technical and procurement personnel
- the cost of communications must be directly borne by government with objective to foster equity in the distribution of federal communications entitlements.

There are over 5,000 local Chambers of Commerce throughout the United States, of which 2,500 are members of the U.S. Chamber in Washington. Forty overseas Chambers of Commerce are members of the U.S. Chamber,* and most developed countries have also established national Chamber and local Chamber organizations.

These organizations are professionally knowledgeable about business operations within their communities, the

* The World Wide Chamber of Commerce Directory, The Johnson Publishing Company, Box 455, Loveland, Colo. 80537.

emergence of newer and smaller businesses, and provide their membership with services of general economic information and analysis; local, state, and federal government rules and regulations, and projections of the future business environment.

All represent an important national resource for the equitable communication of national needs.

Two categories of mission needs have been previously discussed; a constant need for cost improvements to current agency capabilities, and a random need for improvements to current capabilities.

The latter need may come from either internal agency planning, or be the consequence of a technological opportunity.

Federal agencies could annually communicate their constant cost-savings needs to Chambers throughout the U.S. They could communicate capability needs as they are determined and documented in a MENS-type document.

Not all mission needs are of the same priority; some will be more urgent than others, regardless of expected scale of their solution. These could be directly transmitted to local Chambers and a general briefing given by agency planning personnel at several localities. The intent of such briefings would be to convey the agency's mission need to local innovative firms and individuals that are invited by the local Chamber. It would not be a meeting set-up to draw proposed solutions from those who attend, but a meeting designed solely to present and clarify the agency's mission need.

Because national security mission needs can only be constructed by the use of current knowledge, projections of current inventory costs and expected costs of R&D initiatives should not unduly constrain attendance by security classification procedures--most of the mission need information to be conveyed is publicly available in commercial publications and congressional testimony.

A detailed presentation of the rationale which supports goals for defense weapon capability improvement need not be given, but the rationale which supports the mission need's cost goal, could be described as well as unclassified and publicly available characteristics of current weapons. By this procedure defense needs would unquestionably be conveyed to a broader base of innovative talent throughout the U.S. than current practice provides.

Costs to enlist the administrative support of local Chambers should be borne directly by government and not burden any firm, large or small, that is invited to attend.

The suggested method directly links agency needs to local innovative talent, a linkage which is absent from current practice and results in the inequitable distribution of federal communication entitlements. It is recommended that the suggested method be further explored to discover issues and problems inherent in its conceptualization which need to be resolved and solved. The conceivable benefits towards achieving equalities appear to justify a closer examination.

PROCEDURAL MATTERS

This brief concluding section conceptualizes some procedural approaches to implement previously explained policy concepts. It will have little interest to those who may believe that inequalities are not fostered by unwritten and net public policy. It may interest those who have been convinced by previous sections that large-scale economic distortions do, in fact, exist. They may ask, what should be done at procedural levels to implement the policy conceptions which have been described? It should be emphasized that much more would need to be done about implementation matters than will be described in this section. The expertise of agency personnel should be brought to bear on the issues and problems which are bound to arise if the paid proposal approach is accepted in principle for further exploration.

Private Enterprise Response to National Needs

MENS-type statements and communication through local Chambers will motivate some private innovating individuals or groups to participate. The MENS-type statement should contain several agency information items which are of concern to private entrepreneurs:

- a set of pre-qualification technical standards
- a request for monthly rate cost information
- a limitation on the amounts to be directly paid by government.

These information items should be standard additions to any MENS-type statement.

Agency Actions

The soliciting agency would be required to set-aside sufficient funds for direct proposal payments in its annual budget request. How much to "set-aside" should be studied in detail. The following are only suggestions for the amounts which may be involved.

- the initial exploration of ideas which totally replace current inventory; \$100,000 maximum payment per action
- the initial exploration of ideas which retain current products, but are proposed to improve their performance or cost by major part improvements; \$50,000 maximum payment per action

- the initial exploration of ideas which retain the product, major parts, but are proposed to improve the performance or cost by componentry improvements; \$25,000 maximum payment per action
- the initial exploration of ideas which retain the product, major parts, and components, but are proposed to improve the performance or cost of component materials and production methods; \$10,000 maximum payment per action.

Presuming that at least four ideas are to be competitively explored at each innovation mission level, \$750,000 per MENS-type solicitation would be set-aside. The number of MENS-type solicitations, per year, cannot be precisely specified at this time, but presuming that for each mission area one constant and nine capability MENS-type statements were annually released, approximately \$7,500,000 total annual set-aside would be programmed per agency mission area.

It is to be noted that capability or cost improvements may come from innovative introductions at any product level. The product may be proposed to be entirely replaced; retained, but with new major part introductions; components; materials or methods. The freedom to choose any product level as a basis for response to common mission goals would be granted pre-qualified proposers. Common mission goals would apply to judge follow-on funding by the direct R&D contract instrument.

The MENS-type statement should also pre-announce the number of pre-qualified proposers which will be accepted at each product level. Thus (in our example), the MENS-type statement would pre-announce that proposal payment for only four conceptual design proposals at each product level would be financed.

To preclude relative corporate "wealth" from biasing the evaluation of responses, the pre-qualification standards should be strictly adhered to and any additional "brochure type" information graded of zero value.

Retention of Pre-Qualification or Termination

It may be recalled that pre-qualification will have been based on expectations of public goal achievement, and only actual performance may be measured against expectations. To be fair, and to simulate industrial personnel policy, the pre-qualified innovative unit or individual should be given several chances to prove

expectations. The nonfederal supplier particularly must learn about agency procedures, intraagency relations, and other more subtle workings of a bureaucracy. When first entering the federal innovation market by the instrument of direct proposal payment, it stands to reason that nonsubstantive success factors will be largely unknown, certainly relatively unknown as compared to the acquired knowledge of established federal contractors. Several errors in procedure, form, and style should be expected.

The judgment as to when to terminate pre-qualification would be based on the agency sponsor's assessment of the sources unacceptable progress towards achieving public goals, much in the way judgments about retention of employment within private companies is arrived at.

But, again as within private companies, several chances to succeed should be granted. The newly-installed pre-qualified innovation supplier, indeed, has much to learn about matters of procedure, form, and style that had not been previously experienced within private innovation markets. Disqualification for nonsubstantive reasons such as the ~~is~~ would not be fair, and only substantive progress towards goals should be measured and used as a basis for either pre-qualification continuation or termination.

Demand-Pull, Technology-Push

The instrument for initial pre-qualification will have been either a standing or capability mission need which had been transmitted by a local Chamber. Pre-qualification decisions will have been based on agency expectations that the accepted individual, small firm, or large contractor is likely to have creative talent which is appropriate to the achievement of agency mission goals.

This should not by itself mean that pre-qualification selections be limited to only demand-pull responses, but that those selected also should be free to propose technology-push ideas.

The proposal of a technology-push idea is more risky and expensive than responding to demand-pull needs, for demand must be created based on perceptions of a need which has not been formally issued.

The cost to propose a technology-push idea should also be directly paid when proposed by a pre-qualified

source. This privilege is currently granted federal contractors through the IR&D/B&P instrument, and should be equivocated in the procurement policy idea which has been discussed.