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THESIS

FEASIBILITY STUDY OF THE DEPARTMENT OF THE NAVY INVESTING RESEARCH AND DEVELOPMENT FUNDS IN VENTURE CAPITAL FIRMS AS A MEANS TO IDENTIFY TECHNOLOGY

by

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13. ABSTRACT (maximum 200 words)

New and ever-changing threats are facing our nation today. The ability of the Navy to develop, identify, and transfer technology to the hands of Sailors and Marines is more crucial now than ever before. Like other government agencies, the Navy is facing an increasing number of budget restraints. This is causing the Navy to look for new ways to leverage and transfer technology from the commercial sector into existing and developing systems.

This thesis looks at the venture capital community as a possible source of innovation and technology for the Navy. The venture capital community has proven to be efficient at discovering technology that has strong potential to succeed in commercial markets. This thesis looks at the feasibility of the Navy leveraging commercial sector investments to find dual-use technologies that have application in the Navy. By evaluating current government "venture" initiatives and matching them against the Navy's goals for venture capital, this research shows that the Navy could benefit by engaging the venture community. Based on the research, this thesis provides recommendations on how to engage the venture capital community and proposes the structure and organization for a Navy venture initiative.

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ABSTRACT

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I. INTRODUCTION

A. BACKGROUND

For years, the federal government has been the leader in developing technologies such as communication satellites, space travel, the internet, and several other society changing advances. However, in the 1990s, the innovation shifted to the profitable commercial sector. There has been a dramatic shift in Research and Development (R&D) funding in the U.S. economy over the past twenty-five years. Prior to the 1970's, the federal government was the largest contributor to U.S. R&D. Since then, the federal government's contributions have remained fairly flat in constant dollars, while industry has shown growth in funding U.S. R&D each year.[1] Total U.S. R&D spending is projected to exceed $300 billion in 2005 with $190 billion of that being provided from industry R&D programs.[2] This shift in research funding has caused the federal government to find new ways of developing the technology necessary to keep the country competitive in global markets and secure from its enemies.

With the new and ever-changing threats facing our nation today, the ability of the Navy to develop, identify, and transfer technology to the hands of Sailors and Marines is even more crucial now than ever before. The Navy spends roughly $15 to $18 billion dollars each year on Research, Development, Test, and Evaluation (RDT&E).[3] It funds its RDT&E through several programs that include government and private labs, schools and universities, and profit and not-for-profit companies. These programs typically focus on military needs identified by the Navy to these groups. But, is the Navy missing a portion of the R&D community that is developing technologies for the commercial sector that may prove to be useful to the Navy? Is there a sector of emerging technology that

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[1] Kei Koizumi, "R&D Funding Trends in the US Government," American Association for the Advancement of Science (2005), 27 Oct. 2005 <http://www.aaas.org>.

[2] Ross Armbrecht, "AAAS Report XXX: Research and Development FY06," American Association for the Advancement of Science (2005), 28 Oct. 2005 <http://www.aaas.gov>.

[3] "FY2006 Budget Estimates," Department of the Navy Office of Budget, Department of the Navy, 27 Oct. 2005 <http://www.navweb.secnavy.navy.mil>.

the Navy is not aware of? These questions are now being asked and the venture capital (VC) community has been identified as one possible source for insight into the emerging commercial technology market that may facilitate the Navy's need for early awareness of technology.

VC has become a hot topic throughout government. There are several agencies, at all levels of government that are engaged with innovative companies in hopes of transferring useful technology to their organizations. These technologies are being developed for the commercial market, but may have applications in the Navy. There are several programs that the government and the Navy use to fund these initiatives such as Small Business Innovation Research (SBIR), Small Business Technology Transfer (STTR) and Cooperative Research and Development Agreements (CRADA). In the last few years, the government has begun looking at other options for technology identification and transfer. Within the last six years, two venture initiatives have been started: the Central Intelligence Agency's In-Q-Tel and the U.S. Army's OnPoint.

In the late 1990s, the Central Intelligence Agency (CIA) found itself falling behind in technologies that were used in information gathering and management. With the help of some forward-thinking executives, consultants, and a team of lawyers, the CIA established In-Q-Tel. In-Q-Tel was charged with "accessing information technology expertise and technology wherever it exists and bringing it to bear on the information management challenges facing the CIA."[4] In 2002, the United States Army was funded to establish a venture capital initiative to "better collaborative ties with the young, small, growth-oriented companies that take risks and push innovation."[5] The Army decided to start its own private venture capital company called OnPoint.

In 2003, Congress encouraged the Navy to conduct a study on "whether the Navy could benefit from establishing a pilot venture capital fund to enable program mangers to take advantage of higher risk technology developments in a rapid fashion without fear of

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[4] Rick Yannuzzi, "In-Q-tel: A New Partnership Between the CIA and the Private Sector," Defense Intelligence Journal (2000), 28 Oct. 2005 <http://www.cia.gov>.

[5] Jerry Lewis, United States, Cong. House, Department of Defense and Emergency, 107 Cong., 2nd sess., 117, 10 Jan. 2002, 27 Oct. 2005 <http://www.thomas.loc.gov>.

penalty to their existing programs."[6] The Navy's Commercial Technology Transition Office (CTTO) conducted a study and reported its findings to Congress in July 2003. Among other things, the report stated that there was some benefit to the Navy in interacting with the venture community to gain early awareness of emerging commercial technologies.

Does interacting with the venture community require equity investments like the ones made by In-Q-tel and OnPoint? How should the Navy design a program to engage the venture community? This is the focus of the research presented in this paper.

B. OBJECTIVES

This research draws upon the Department of the Navy's (DoN) initiative to fund limited research and development projects with funds directed to VC firms as currently being studied by the Assistant Secretary of the Navy (FM&C) and the Deputy Assistant Secretary of the Navy (RDT&E). The objective is to analyze the feasibility of investing in VC firms and if the research supports such investments, provide recommendations on how to employ the VC firms to maximize the benefit to the Navy.

C. RESEARCH QUESTIONS

The primary question considered in this research paper is: Should the DoN invest research and development funds into VC firms as a way to gain access to emerging commercial technologies?

To answer the primary question, the following secondary questions were addressed. 1) What has resulted from other government agencies' investments in VC firms? 2) What are the costs associated with retaining or starting a VC firm? 3) Who is identifying the need for the technology and who is currently identifying the technology?

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[6] Jerry Lewis, United States, Cong. House, DEPARTMENT OF DEFENSE, 107 Cong., 2nd sess., 532, 25 June 2003, 27 Oct. 2005 <http://www.thomas.loc.gov>.

4) If it is determined that the DoN should invest in VC firms, how should the Navy carry out such investments? 5) Is it necessary for the Navy to make equity investments to gain access to technology? 6) What ethical considerations must be taken into account before investing in a VC firm?

D. SCOPE OF THESIS

This thesis provides an in-depth assessment as to whether the Department of the Navy should engage the VC community or not. This was accomplished by looking at current government venture type programs and comparing their objectives with those of the Navy. The research conducted on these programs was limited to DoD involvement. The research focused on gaining expert opinions from department officials, VC fund managers, and individuals in the business community. It further examined the portfolio of the two government backed VC firms to determine the focus of their investments and the return on those investments.

Once research was underway, it was determined that there were limited financial and historical data available on the two programs that most closely related to full VC engagement. Unfortunately, this limited the scope of the thesis and did not allow for a statistical analysis of these two organizations.

E. METHODOLOGY

The first step in the research was to conduct a literature review from books, professional journals, the internet, and other information sources in order to understand the current VC market and the industry in which it operates. The second was to determine the Navy's objectives for the venture community by interviewing senior DoN officials and government employees who have already had limited engagements with the VC community. The third step was to determine the feasibility of the Navy's engaging the VC community by interviewing business leaders, special interest groups, and

academics. In addition, these interviews helped to define the ways in which the VC community would likely be willing to interact with the Navy. Next, alternatives for engaging venture capitalists were determined. To do this, different government venture programs were reviewed to examine how each program allowed or encouraged interaction with the venture community. Finally, from the research conducted, a suggested course of action was determined.

F. ORGANIZATION OF STUDY

The organization of the study closely follows the methodology described above. Chapter II gives a broad overview of the VC community. The objective of this section is to understand how the industry operates in order to better address the goals and involvement of the DoN in the VC industry. Chapter III addresses recent government programs that attempt to reach the highly innovative companies that VC firms are attracted to. The section focuses on DoD involvement in these programs with the exception of the CIA's program. Chapter IV discusses possible options the Navy could undertake if it wishes to enter into or interact with the VC industry. Chapter V states our recommendation for the Navy's involvement in venture capital. It also gives suggestions on how to structure, organize, and fund the initiative. Chapter VI summarizes our research and contains concluding remarks.

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II. VENTURE CAPITAL OVERVIEW

This chapter will examine the VC industry and provide a brief overview of how VC firms in that industry operate. The objective of this section is to understand how the industry operates in order to better address the goals and involvement of the Department of the Navy (DoN) in the VC industry. Specifically, this section will examine the following:

- History and nature of the VC industry
- Performance of VC firms
- How VC firms are structured
- How VC firms are compensated
- How VC firms invest money
- How VC firms use staged investments
- How VC firms oversee firms they are managing
- How VC firms terminate investments

This chapter is not intended to be an all-inclusive look into the VC community, but rather to serve as an overview of private sector involvement in VC. Later sections of the paper will focus on how the Navy should consider investments into VC.

A. NATURE, HISTORY AND PERFORMANCE OF VC

VC is one possible solution for firms that are trying to raise money but do not have access to traditional financing methods, such as public markets or bank financing. Venture capitalists provide capital in exchange for partial ownership and management of the firm. Venture capitalists serve not only as financiers to the companies in which they invest, but also as advisors, managers and most importantly, entrepreneurs. Their goal is to make money for themselves and their investors.

While the current VC industry has been around in one form or another since World War II, it has been garnering attention only in the last 20 years. The first true

American VC firm was American Research and Development (ARD) founded by MIT President Karl Compton and Harvard Business School Professor Georges F. Doriot in 1946. This firm made most of its profit by making a $70,000 investment in Digital Equipment Company in 1956 which eventually grew to a value of $355 million[7]. Today, the VC industry is a powerful force and a major driver in the U.S. economy.

Estimates suggest that in 2003, the VC industry was directly responsible for over 10 million jobs and $1.8 trillion in sales. These numbers translate to approximately 9.4% of the total U.S. private sector employment and approximately 9.6% of private company sales. These numbers become even more significant when considering that the VC industry has been responsible for less than two percent of the total equity investment over the past 34 years.[8]

Even though VC constitutes a relatively small portion of the total equity investments, the VC industry has been growing. This growth can be seen by looking at the number of VC firms in existence, the number of VC funds in existence or the total VC capital under management (Figure 1).[9] This trend shows no signs of slowing down either based on the amount of new VC capital raised or total VC capital under management (Figure 2).[10]

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[7] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

[8] Venture Impact 2004, Arlington, VA: Global Insight, 2005, Venture Capital Benefits to the U.S. Economy, 28 July 2005 <http://www.nvca.org>.

[9] National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

[10] Ibid.

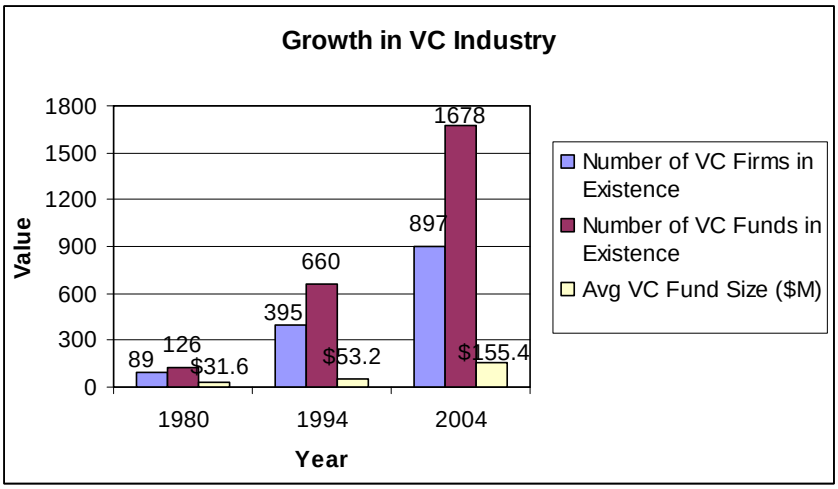

Figure 1. Growth in VC Industry

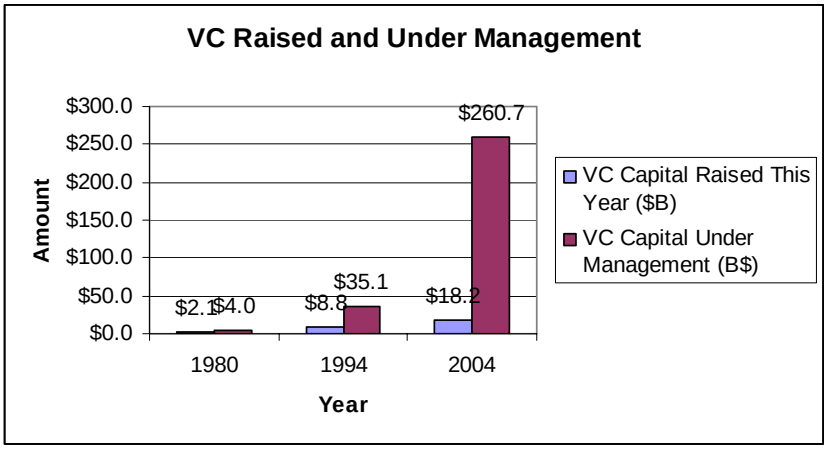

Figure 2. VC Raised and Under Management

These numbers just tell the beginning of the story. Recently, the VC industry has been attracting attention because VC backed companies have consistently outperformed non-VC backed companies. In a recent study, *Global Insights* analyzed ten industry sectors in which VC firms invest[11]. The VC investments in these sectors were compared against non-VC investments in the same sectors and analyzed for employment growth. Eight of the ten sectors showed growth and in every case the VC firms outperformed the non-VC backed firms. In the two sectors where the VC firms did not show growth, they showed significantly less decline than the non-VC backed firms. The end result was that

[11] Venture Impact 2004, Arlington, VA: Global Insight, 2005, Venture Capital Benefits to the U.S. Economy, 28 Jul. 2005 <http://www.nvca.org>.

between 2000 and 2003, employment at VC backed firms grew at an average rate of 6.5% while total employment growth was down 2.3% (Figure 3).[12]

This same study also analyzed sales growth at VC backed firms and compared the results to non-VC backed firms. The study found that between 2000 and 2003, sales at VC backed firms grew at a rate of 11.6% while sales at non-VC back firms grew at a rate of 6.5%. Again, in all ten sectors analyzed, the VC backed firms outperformed the non-VC backed firms (Figure 4).[13] VC investments also performed well when compared to public markets, consistently outperforming both the NASDAQ and S&P 500 when considering a five year rolling average return (Figure 5). [14]

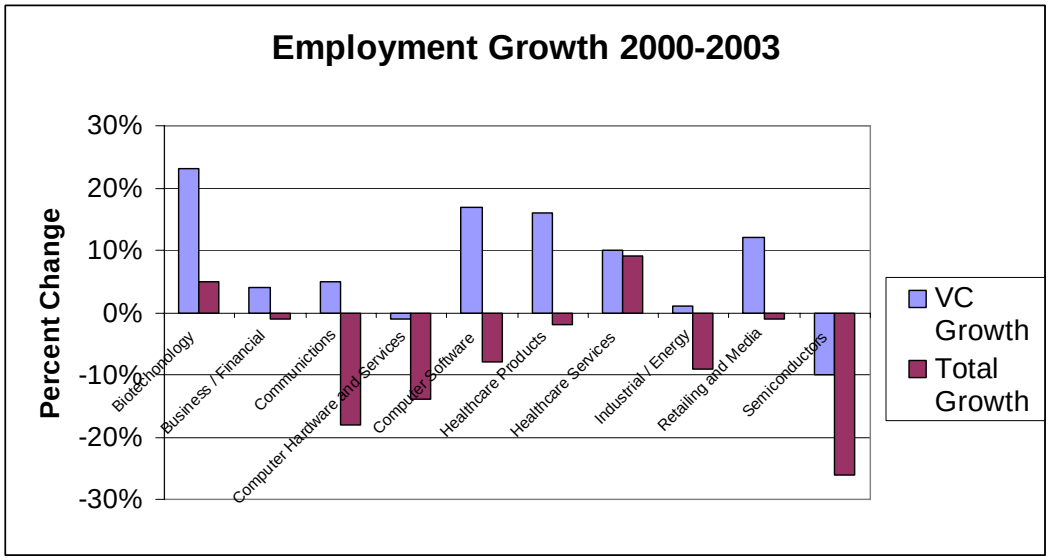

Figure 3. Employment Growth 2000-2003

12 Venture Impact 2004, Arlington, VA: Global Insight, 2005, Venture Capital Benefits to the U.S. Economy, 28 Jul. 2005 <http://www.nvca.org>.

13 Ibid

14 National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

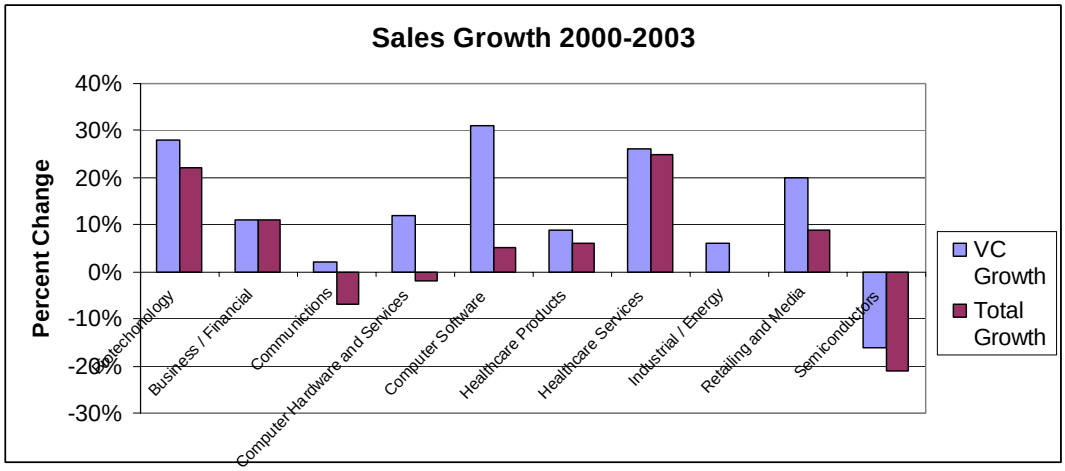

Figure 4. Sales Growth 2000-2003

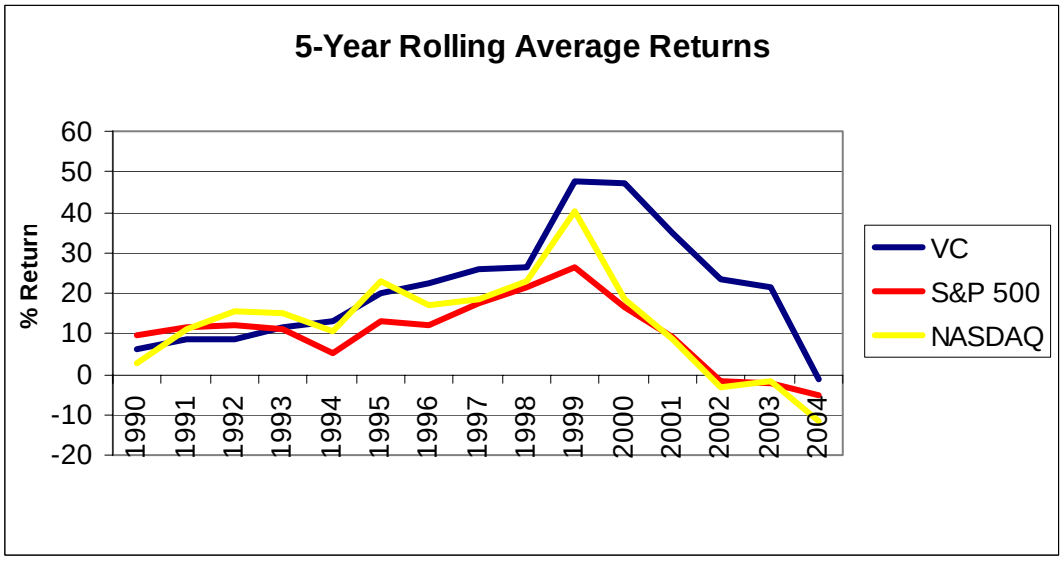

Figure 5. 5-Year Rolling Average Returns

While these figures are impressive to the public and generate attention for the VC industry, the Department of Defense's (DoD) interest in the VC community does not revolve around sales growth or employment growth. The driver of DoD's interest in VC is the way VC spurs innovation in the form of new products for commercial markets. In the same *Global Insights* study discussed above, it was found that when adjusted for the size of a firm, VC backed companies spend over twice as much on research and development (R&D) as non-VC backed firms. To put this in perspective, the study found that in 1984, firms with fewer than 500 employees accounted for $4.4 billion (5.9%) of total U.S. R&D. In 2003, firms with less than 500 people contributed approximately

$40.1 billion (20.7%) of the total U.S. R&D funding. The study implies that much of this growth in R&D can be attributed to VC investments[15].

Another study conducted by Dr. Josh Lerner and Dr. Samuel Kortun found that between 1983 and 1992, while VC funding averaged less than 3% of corporate R&D, it was responsible for approximate 8% of industrial innovations during the same period[16]. Clearly, it would seem that the VC industry creates efficiencies that cannot be found elsewhere.

B. VENTURE CAPITAL FIRM STRUCTURE

It can be argued that many of the efficiencies for which VC firms are recognized stem from the way they are organized. Again, a VC fund exists to make money for its investors and does this by investing in other companies, managing the companies, taking a portion of their earnings and then spinning off the companies. In order to accomplish this series of events, a VC firm is usually structured as a limited partnership which has two types of partners that play a role in the fund. These two types of partners are general partners and limited partners.[17]

General partners are responsible for the daily management of the VC fund. They assume all of the liability for the debt of the fund, hold board seats in the firms they invest in, and are responsible for turning a profit. A limited partner is an investor in the fund who puts up money, but is not involved in the daily operation of the funds. In some cases, limited partners can take seats as observers on the boards of the companies in which the VC firms invest, but must be careful not to get involved in the firm's operations if they wish to retain their limited liability position.[18]

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15 National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

16 Samuel Kortum, and Josh Lerner, "Assessing the contribution of Venture Capital to Innovation," Rand Journal of Economics (2000), 28 Oct. 2005 <http://www.rje.org>.

17 Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

18 Ibid.

In order to manage the relationships between the general partners and the limited partners, a VC firm must establish covenants at its inception which limit and guide the behavior of the fund and its partners. Gompers and Lerner identify 14 classes of covenants which are used to manage a VC firm.[19] We will not go into detail regarding the 14 classes of covenants, however it is important to briefly address the role of covenants in a VC fund because it is something the Navy will need to consider prior to deciding whether to invest in VC. As such, we will briefly cover three groups of covenants that Gompers and Lerner identify as being crucial to a VC fund.

The first group that must be considered are covenants relating to a fund's management. These types of covenants can place limits on the amount of money a fund can invest, limit the use of debt and equity financing, and limit co-investments with other venture funds. Like most covenants, those that relate to a fund's management are designed to protect the limited partners by placing restrictions on what the general partners can and cannot do. Since the limited partners are not involved in a fund's daily operations, they must rely on these management covenants to limit the fund's risk.[20]

The second group of covenants that Gompers and Lerner identify are covenants that relate to the activities of the general partners. These covenants can include limits on the number of general partners, the size of personal investments by the general partners in the fund, in addition to restricting the general partners' ability to sell their portion of the investment and the VC's fundraising activities (which can increase a fund's management fee). Like the management covenants, these covenants are designed to protect the limited partners against risk of exposure as the result of the general partners' actions.[21]

The final group of covenants that Gompers and Lerner identify are covenants which restrict the types of investments a VC fund can make. Examples of these types of covenants can include limits on the class of investments that can be made (such as public securities) or limits on the percentage of investments that can be made into a specific type of investment. Like the previous two classes of covenants, these covenants are designed

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[19] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

[20] Ibid.

[21] Ibid.

to protect the limited partners from the general partners' actions by aligning the general partners' investments to the type that the limited partners wish to make.

C. VENTURE CAPITAL COMPENSATION

As with most industries, financial compensation is the main incentive mechanism that limited partners in VC firms have to control the actions of the general partners. When a VC firm is established, the compensation plan will be clearly defined in the original partnership agreement. For a VC firm, the compensation plan will normally specify a set percentage of the fund's capital to be paid to the general partners as a management fee and include a provision to give the management a percentage of the fund's earnings called a "carry."[22] Over the life of a typical VC fund, the net present value (NPV) of the management fees ranges from 7% to 18% of capital raised, while the carry is normally valued from 12.5% to 30% of the fund's profit.[23]

The typical compensation plan normally centers on what is called the 2/20 plan. This type of plan means that the general partners receive a yearly management fee of 2% of the fund's capital plus 20% of any profit the fund generates. While there are no firm data to support this compensation plan as the industry standard, the numbers came up in numerous interviews with venture capitalists who act as general partners.[24] Gompers and Lerner also note that the average VC general manager receives a management fee of 2.5% in addition to 20% of the earnings. As a result of all of this, we feel that 2/20 represents a good figure for an industry compensation approximation.[25]

More important than the 2/20 number is the way the compensation plan can be used to motivate the fund's general partners' behavior and the way that it can attract

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[22] Karthic Jayaraman, personal interview, 18 Jun 2005.

[23] Kate Litvak, "Venture Capital Limited Partnership Agreements: Understanding Compensation Arrangements," Columbia Law School and Economics Working Paper No. 254 (2004), 29 Oct. 2005 <http://law.utexas.edu/law>.

[24] Based on interviews conducted with Mr. Howard Strateman, Mr. Karthic Jayaraman and Mr. Jason Rottenberg.

[25] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

general partners. Gompers and Lerner note that "leading venture capitalists may be able to extract a higher pay than their less seasoned counterparts because investors want to invest in their next fund."[26] This means that experience in the VC community seems to matter and that greater experience entails higher compensation.

This point is especially relevant in today's VC community. Many researchers feel that the success of the VC community has attracted many new entrants who may not have the experience required to properly manage a fund. Gompers and Lerner suggest that newcomers to the industry are no better at predicting their investment ability than the investor (limited partners).[27] As such, if venture capitalists do not have established reputations, they cannot set their own price and must be price takers, accepting below average management and compensation fees upon start-up. This view is consistent with the above view that a successful reputation may allow the venture capitalist to command a premium over the rest of the market.

Another recently published paper by Gompers and others has also highlighted this point and seems to validate Gompers' earlier assumptions in *The Venture Capital Cycle*. Specifically, in the working paper titled *Venture Capital Investment Cycles: the Impact of Public Markets,* the authors acknowledge that "industry specific human capital is an important channel though which experience influences the reactions of venture capital firms to shift public market signals." The paper goes on to state that "the venture capital industry is driven mostly by the more successful venture firms, that is, those with the most experience."[28] This view also means that the experienced venture capitalists seem to lead their industry and that the inexperienced venture capitalists follow the experienced. Simply stated, it seems that experience drives the industry and that prior to investing in VC, it is beneficial to have experience on your side.

While Gompers' research on VC compensation is well accepted, a recently published paper discussing the compensation arrangements in more detail also is worth

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[26] Paul A. Gompers and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

[27] Ibid.

[28] Paul Gompers, Anna Kovner, Josh Lerner, and David Scharfstein, "Venture Capital Investment Cycles: The Impact of Public Markets," National Bureau of Economic Research (2005), 29 July 2005 <http://www.nber.org>.

noting. In a paper titled, *Venture Capital Limited Partnership Agreements: Understanding Compensation Arrangements,* Kate Litvak expands on some of Gompers research on VC compensation. Litvak finds that while in general "better venture capitalists earn higher overall compensation" she also finds that management fees decline as a percentage of fund size when the fund size increases, management fees and carry move in the same direction and that top venture capitalists do indeed charge more for their services.[29]

To discuss her findings in more detail, Litvak identifies four main methods of management compensation that venture capitalists use to charge for their services. The first method is a flat management fee based on a percentage of *committed* capital. This means that a venture capitalist will receive a fixed percentage of money based on the investments made. The second method is the declining fee based on a declining percentage of committed capital. This system is similar to the previous system with the exception that the fee decreases with time, most likely because committed capital increases with time.[30]

The third method is a declining fee based on a combination of *committed* capital and *managed* capital. This plan differs from the previous two because it also considers managed capital. In the previous plans, the management fee was based on committed capital and neglected the capital that the fund managed but had not yet committed. The fourth method is a fee based on managed capital. Although this method is mentioned in the paper, Litvak found no firms that actively used it.

D. OVERVIEW OF VENTURE CAPITAL INVESTING

As stated in the beginning of this section, small firms turn to VC as a way to secure funding when traditional means such as banks are not feasible. Gompers and

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[29] Kate Litvak, "Venture Capital Limited Partnership Agreements: Understanding Compensation Arrangements," Columbia Law School and Economics Working Paper No. 254 (2004), 29 Oct. 2005 <http://law.utexas.edu/law>.

[30] Ibid.

Lerner identify four critical factors that may limit a small firm's ability to get access to capital.[31]

1. uncertainty
2. asymmetric information
3. nature of a firm's assets
4. condition of relative financial and product markets

In the DoN context, these four factors may, at first, seem insignificant. We feel that these four traits, while not significant to the Navy from a financing perspective, are significant to the government as proxies for risks that are inherent to the VC community.

The first factor that can lead a small firm to seek VC backing is uncertainty in the product it is developing. This uncertainty could include the technology, rival firms, or product placement. The inherent risk that the uncertainty brings will require the firm seeking the VC backing to forgo a significant portion of the possible returns in the form of compensation to the VC firm.[32]

The second factor is the small firm's or entrepreneur's asymmetric information. In this sense, Gompers and Lerner refer to asymmetric information as information that the entrepreneur knows but may not disclose to the investor. The concern is that the entrepreneur is making decisions that the investors do not know about or are uninformed about. The threat of an entrepreneur using asymmetric information may prevent them from receiving capital from traditional sources.[33]

The third factor is the nature of a firm's assets.[34] If a firm has tangible assets, it may be easier for it to secure financing because its collateral can be put up against the loan. Small firms that are backed by VC do not usually have the assets to put up for collateral and as such, find traditional financing difficult.

The final factor identified is the market conditions that the entrepreneur is facing. These market conditions include not only conditions within the capital markets, but also

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[31] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

[32] Ibid

[33] Ibid.

[34] Ibid.

within the product markets as well. Gompers and Lerner state that many times in capital markets, the cost of capital and the supply of capital make it impossible for a small firm to get access to the capital. Along with this argument, our research conducted by interviewing venture capitalists suggests that in many instances, the capital markets which provide traditional financing do not recognize the potential profitability of the small firms and do not take the time to research the product markets.[35]

Analysis of these factors suggests that small firms turn to VC as a way to secure capital because in many cases, the firms are deemed too risky for traditional sources of financing. When a firm secures financing from VC, it forgoes a portion of ownership to the VC firm and also loses the autonomy that many traditional financing avenues would have provided. By accepting VC backing, a firm is accepting a new management partner.

The other side to this argument is that VC firms provide financing to these firms. If VC firms are providing financing, they must see something that the traditional sources of financing do not. Here, research suggests that the difference is the level of involvement that a VC firm takes in its investments.[36]

Before investing in a firm, the venture capitalist will have to carefully analyze the business plan. If the VC firm sees a prospect of success, then it will provide financing in exchange for part ownership of the firm. Along with this ownership comes the ability to shape the direction of the firm through management, which is normally done by accepting a seat on the board of directors.[37] A study done in 1989 by Gorman and Sahlman show this unique management relationship at work. In their study, Gorman and Sahlman found that between financing rounds, the lead venture capitalist will normally visit the VC backed firm once a month and spend between four to five hours with them during that visit. They also found that the non-lead venture capitalist will normally visit the VC backed firm once per quarter and that visit will normally last for between two to

[35] Howard Strateman, personal interview, 18 June 2005

[36] Jason Rottenberg, personal interview, June 2005.

[37] Ibid.

three hours.[38] This shows that VC firms have a level of knowledge and understanding that may provide them with unique insight into their investment's potential.

Another unique feature of VC investments is that the general partners of a VC firm know they are not going to get the returns commensurate with the risk on most of the investments they make. VC funds accept risk in exchange for the *possibility* of larger returns, knowing full well that all of their investments will not pay off. Again, the VC community is unique because VC firms leverage off each other. Many times, a VC backed firm will put up a portion of the total financing required along with other VC funds. This provides two benefits. First, it allows the VC firm to have insight into the industry and learn about the firm's business. Second, it allows the VC firm to make many more investments and spread around its risk.[39]

It is also not unusual for a VC fund to invest in competing technologies because in the end, the VC firm assumes that one of the technologies will pay off. Investing in competing technologies also allows the VC fund to merge different firms with competing technologies in its portfolio when it has identified which one will be the "winner."[40] In the end, the choice to use VC funds is about risk exposure and risk mitigation.

E. STAGED INVESTMENTS

While it may not seem initially obvious, venture capitalists are in the business of risk management for the limited liability partners. In the previous pages, we addressed why entrepreneurs turn to VC firms as a means to get capital for their projects. Simply put, entrepreneurs turn to VC firms because in most cases, new start ups with unproven technologies are deemed too risky for traditional financing methods. Venture capitalists

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[38] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

[39] Steven Mendel, personal interview, 25 July 2005.

[40] Ibid.

understand this risk better than anyone and have developed tools to mitigate this risk. One of the most powerful tools the venture capitalist has is the ability to stage investments.[41]

Staging investments means that the venture capitalist will not invest all of the required capital at once but instead, will do it incrementally, on an as-needed basis. With respect to risk mitigation, Gompers and Lerner note that the use of staged investments solves the two basic problems inherent in any VC endeavor, the principal-agent problem and entrepreneur asymmetric information.[42]

The principal-agent problem, addressed by agency theory, refers to the concept that the agents, or entrepreneurs, will not always act in the best interest of the investors or venture capitalists, who are the principals. While this may initially seem counterintuitive, research over the past 30 years indicates that the agents will not always maximize value to the shareholders.[43] To a venture capitalist, this could mean that the entrepreneur may not make the best use of the investments made by a VC firm.

Staged investments help solve this problem because they allow the venture capitalists to check for progress before making additional investments. If the venture capitalists do not like what they see, they can refuse to fund the project until their needs are met. Once the venture capitalists see progress, they will resume funding. Conceptually, this process can be compared to the milestone decision points under typical DoD acquisition contracts. In the DoD system, research and development programs must meet certain milestone criteria to continue to be funded. These criteria include measurements on efficiency, funding, technology development and feasibility, and management, just to name a few.

The second reason, according to Gompers and Lerner, that VC firms use staged investments is to counter any asymmetric information that the entrepreneur may have. The reason behind this is not much different than agency theory. When a venture

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41 Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

42 Ibid

43 Richard A. Brealey, and Stewart C. Myers, Principles of corporate finance, 7th ed., Boston, Mass: McGraw-Hill/Irwin, 2003.

capitalist makes an investment in a new company, the entrepreneur knows much more about the product than the venture capitalist. The entrepreneur may know that there is a better technology out there coming to market that the venture capitalist does not know about. Even though the entrepreneur knows this, he/she may still try to extract money from the venture capitalist to support a project that may not result in the return the venture capitalist expects. Staged funding helps solve this problem because it allows the venture capitalist to learn about the technology, the industry and the competition as time goes on before investing too much money in a project that has a low or negative net present value (NPV).[44]

While Gompers and Lerner have received much support for their ideas with respect to the reasons for staged financing, there is another paper that we feel also highlights an important use of staged financing. Darwin V. Neher notes in a paper published in 1999 that staged financing's main use is to allow the venture capitalists to control the assets in their investments.[45] The main difference in Neher's view is that staged financing adjusts to reflect the value of the different assets to the investor. At the beginning of a VC investment, Neher argues that there are normally very few tangible assets that the venture capitalist can recover from an investment. As such, the main asset at the early stage is human capital in the form of the entrepreneur. Staged investments in a firm give the venture capitalist a lever of control over the assets. As the firm grows and matures, more tangible assets exist for a venture capitalist to use and less emphasis is placed on the human capital.[46]

Neher's view on staged financing can be reconciled with Gompers and Lerner's views on staged financing. Neher notes that each new stage of financing should coincide with some significant development in the firm or its product. At each new stage, Neher notes that some of the project's ambiguity is removed (through revised NPV assessments and tangible assets than can be used by the venture capitalist) and that justifies more

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[44] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

[45] Darwin V. Neher, "Staged Financing: An Agency Perspective," Review of Economic Studies 1999.

[46] Ibid.

money being infused.[47] Gompers and Lerner note that firms with higher R&D and a lower ratio of tangible assets receive more rounds of financing. Firms with lower R&D but more tangible assets receive fewer staged investments.[48] This suggests that the tangible assets reduce the venture capitalist's concern over the investment's ambiguity because the assets provide a means to recover some of the capital invested.

With the reasons for staged financing established, we will now briefly look at the different stages of financing that VC firms use. Figure 6 shows a summary of 794 venture backed firms that Gompers and Lerner analyzed to study staged financing.[49] The conclusion from this is that there seems to be a trend of later stages receiving more funding. We believe that this can be traced to the reasons identified above. As time goes on, the ambiguity of the investment seems to be lessened. Gompers and Lerner note that firms that go public receive between $3.36 and $5.67 million more than firms that remain private.[50]

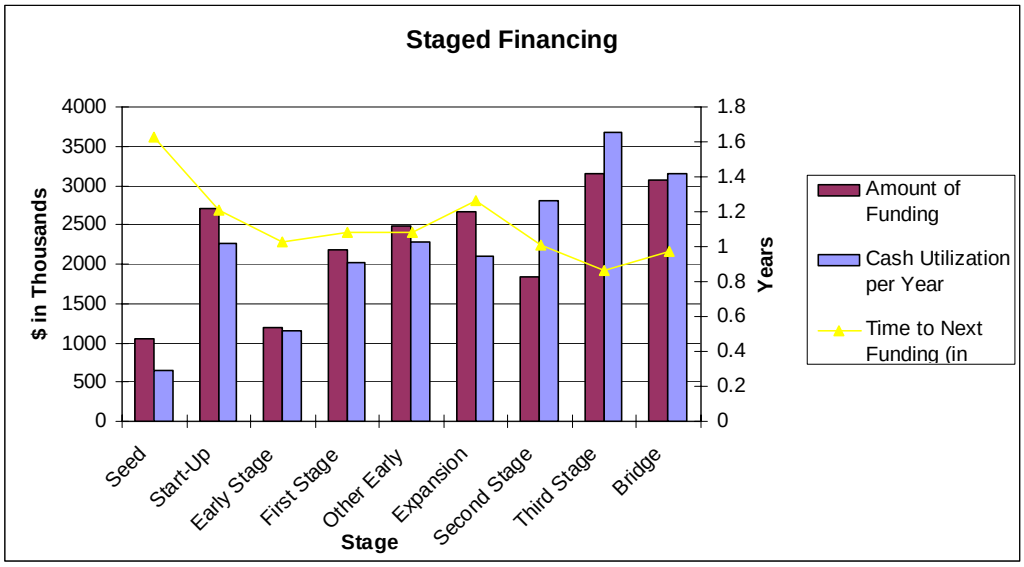

Figure 6. VC Funding Levels by Stage

[47] Darwin V. Neher, "Staged Financing: An Agency Perspective," Review of Economic Studies 1999.

[48] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

[49] This chart was compiled based on data presented in *The Venture Capital Cycle* on page 155. All information was compiled and analyzed by Paul Gompers and Josh Lerner. This chart is simply a graphical representation of their findings.

[50] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

This should come as no surprise because it is when firms go public that venture capitalists make most of their profit. The ultimate goal of a venture capitalist is to take a firm public, and reap the benefits. This will normally require more investments and, as the technology or product become more defined; the venture capitalist will increase the funding because the business plan has become more certain. If, on the other hand, it is determined that the product being developed is not going to be successful, the venture capitalist will not make any later stage investments and instead, will focus on exiting the investment.

F. VENTURE CAPITALIST OVERSIGHT OF INVESTMENTS

Up to this point, we have mainly discussed the role of venture capitalists as investors in funds while only briefly touching on their role as active participants in the funds they invest in. VC involvement is commonly considered to be a cash infusion into a firm. This is an oversimplification since VC firms become active participants in the funds they manage. Our analysis suggests that venture capitalists are specific to certain industries in that once they have made investments in the industry, they become knowledgeable about the industry and can reduce information asymmetries.

Unlike traditional types of financing methods that are available, VC is unique because of the involvement of the general partners in their investments. To the venture capitalists that are making the investments, the risk they assume provides the justification for their involvement. The fact that there is a demand for, and supply of VC money seems to provide validation that not only do the investors think the system works well, but the entrepreneurs are willing to forgo ownership and autonomy in the hope of making a profit. Aside from the cash infusions that a venture capitalist makes into a firm, investors also must consider the cost to oversee the investments that the venture capitalists make.

When a venture capitalist makes an investment in a firm, that investment usually buys the venture capitalist a seat on the board. It is from this position that the venture capitalist provides the oversight to the firm. Even though the venture capitalists made an

investment, they still incur substantial costs as a result of the board seat. One of the biggest costs that Gompers and Lerner identify are the transaction costs associated with maintaining the seat.[51]

Many of these transactions costs seem to stem from travel related expenses. As a result, it is not unusual to find VCs located close to their investments. In a study Gompers and Lerner conducted, it was found that over half of the VC backed firms analyzed had a venture representative within 60 miles of their investments.[52] This can be important because many industries are centered around a specific geographic location, as are VC firms.

California has, by far, the highest percentage of VC backed firms. In 2003, it is estimated that almost 2.5 million people in the state worked for a VC backed company. Texas was a distant second with an estimated 900,000 people employed by VC backed firms, with Massachusetts ranking number three with a little over 700,000 people employed by VC backed firms.[53]

The geographic location of VC firms plays a huge role in the degree of involvement because while the general partners can (and should) be located close to the action, the limited partners do not need to be geographically as close. As a potential investor in VC, it is important for the Navy to understand the relationship between the venture capitalist firm and its investments. The VC general partners are the middle men in the chain that has the entrepreneur at one end and the limited partners (e.g. the Navy) on the other. The limited partners allow the general partners to invest the money and then, later, the general partners will report back to the limited partners on the progress and distribute returns, (if any). As a limited partner, the investor who supplies the venture capitalist with money is usually not an active participant in the investment. Based on how the VC firm is structured, the investor can inform the general partners about how much they want to know about the investments, but the general partners are the ones providing the oversight.

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[51] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

[52] Ibid

[53] Venture Impact 2004, Arlington, VA: Global Insight, 2005, Venture Capital Benefits to the U.S. Economy, 28 July 2005 <http://www.nvca.org>.

G. EXITING VC INVESTMENTS

As we have previously stated, venture capitalists are in the business to make money for themselves and their partners. The investments that they make are the vehicles which allow them to make a return. The best way for the venture capitalists to make a profit is to take their investments public, which is often when the venture capitalist exit the investment, and distribute the returns to the investors.[54]

On average, the typical private equity fund is liquidated after about a ten year life. This implies that a venture capitalist will only invest in a company if he or she thinks that can be developed or sold within a period of less than ten years.[55] While this ten year figure is an average across numerous industries, it is important in the sense that it shows that VC funds do indeed, have a finite life, and that no VC investment is started without an exit strategy being considered.

Recent data from 2004 show that different sectors also have different average life spans. As should be expected, higher technology sectors have shorter life spans. The chart below (Figure 7) summarizes the data across VC industry sectors for 2004.

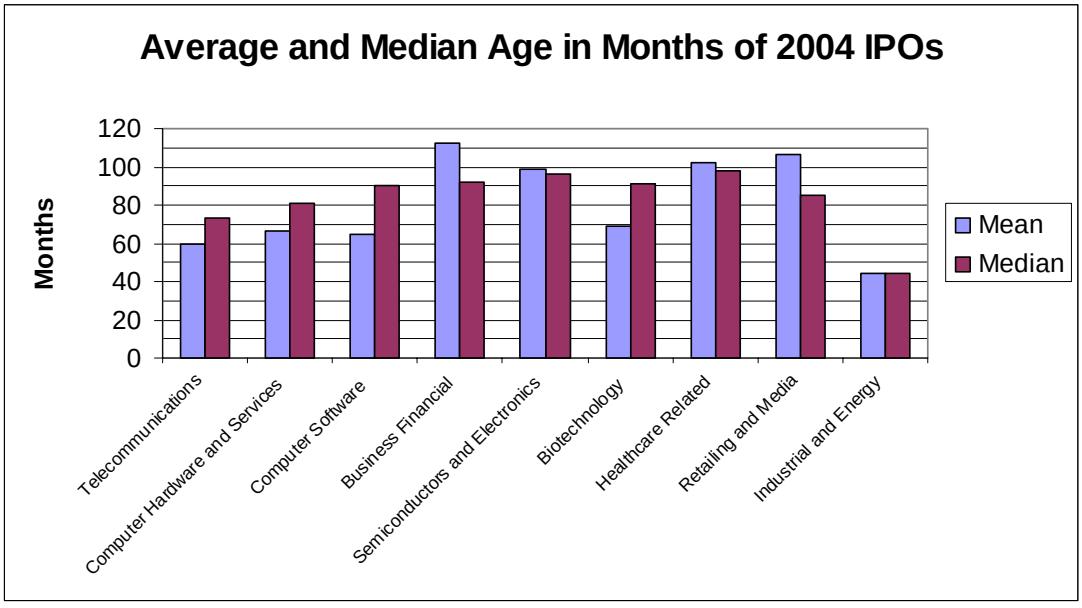

Figure 7. Average and Median Age in Months of 2004 IPOs

[54] Karthic Jayaraman, personal interview, 18 June 2005.

[55] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

While it is impossible to generalize why and when a venture capitalist will take a firm public, Gompers and Lerner identify two major factors that affect a decision to exit a profitable investment:

1. Market Conditions at the Initial Public Offering (IPO)
2. Reputation of the VC firm presenting the IPO.

Market conditions are arguably the most important factor in taking a firm public because the value of the investment is dependent on the public's perception of the firm's value. Gompers and Lerner's research indicates those experienced venture capitalists are better able to time an IPO to the correct market conditions.[56] The second condition that Gompers and Lerner identify is the reputation of the VC firm. While this initially may seem rather insignificant, it turns out to be a major factor in a venture capitalist's decision to take an investment public.

There are two reasons for this. First, as we have identified earlier in this paper, the experience level of a venture capitalist does indeed matter. As a result, Gompers and Lerner suggest that younger, more inexperienced venture capitalists may try to exit an investment before the optimal exit time as a way to signal other investors of their success.[57] The reasoning behind this is actually somewhat complex and deals with the life of a VC fund.

As previously discussed, the life of a VC fund rarely exceeds ten years. This limit means that a venture capitalist will normally start another fund every few years as a way to always have investment opportunities. The lifespan of a VC fund also means that rarely are any more investments made after the fund has existed for five years. It is at this point that a venture capitalist will start looking to raise a new fund. When raising a new fund, the venture capitalist will need to demonstrate success so that he/she may exit investments prior to the maturity to show capital appreciation to potential investors. Gompers calls this "grandstanding" and this is something that can affect the decision to exit a profitable investment before the investment is fully mature.[58]

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[56] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT Press, 1999.

[57] Ibid.

[58] Ibid.

While market conditions and "grandstanding" are two factors to consider when an investment appreciates, not all investments appreciate. Based on interviews conducted, it does not seem unusual to have only two to five percent of investments pay off with the returns commensurate with the risk taken.[59] That leads to the question of what to do with investments that do not appreciate as expected. Normally they are not taken public but the venture capitalists still must exit these investments.

This is again an area where industry knowledge can pay off for a venture capitalist. We have already established that VC funds do not put all of their eggs in one basket, but most do not diversify across sectors. If a venture capitalist knows that there is a promising technology in a given industry sector, but is not sure which one will succeed, the venture capitalist will normally place investments on numerous competing technologies.[60] The venture capitalist knows that one of the technologies will eventually win out but at the early stages does not know which one. After a few years of operating the fund, the venture capitalist will have a better idea as to which technology has the best chance for success and the venture capitalist can then place additional investments into the expected "winner". It is at this point where the venture capitalist has some options with the "losers".

The first thing that a venture capitalist can do with a loser is to simply pull funding and close the company down. The money invested can be considered a sunk cost. While the money invested in the closed company was not a profitable investment, in most cases, the venture capitalist should have been able to gain industry exposure. The second option that a venture capitalist firm can exercise is to fold the unprofitable firm into one of its more profitable investments in a competing technology. While it may seem counterintuitive to invest in a competing technology, the venture capitalists need to manage risk and one tool for this is to invest in competing technologies. By investing in competing technologies, risk is mitigated by ensuring you pick the winner. However, the return is lower because the high return on the winner is offset by the lower return on the loser. The assets of the unsuccessful firm can normally be put to use in another of the

[59] Karthic Jayarman, personal interview, 25 July 2005 and Howard Strateman, personal interview 25 July 2005.

[60] Steven Mendel, personal interview, 25 July 2005.

venture capitalist's investments. The third option is to spin the investment off to another venture capitalist who may be able to benefit from the technology or expand on the research.[61]

When considering exiting investments, it is important to remember that most investments that a VC fund makes will not generate the returns commensurate with the risk taken. As a result, the VC fund will have to divest itself of many investments that are not profitable. While these investments did not return a monetary profit, they hopefully provided the venture capitalists with industry insight to help them make better investment decisions in the future.

When considering the profitable investments, the venture capitalist fund will also have to consider how to divest himself or herself from these investments as well. When exiting profitable investments, the venture capitalist's major consideration will need to be the market because the public will be the ones valuing the firm. Secondary considerations that the investors need to consider are the venture capitalist's reputation and timing of the IPO.

61 Karthic Jayarman, personal interview, 25 July 2005 and Howard Strateman, personal interview 25 July 2005.

III. GOVERNMENT VENTURE CAPITAL INITIATIVES

This chapter of the paper will address recent government forays into the VC community. Most of this chapter will be limited to DoD involvement in VC with the exception of the CIA's program and certain aspects of the Small Business Innovation Research (SBIR) program. Specifically, this chapter will address the following:

- CTTO – U.S. Navy's Commercial Technology Transition Office
- CRADA – Cooperative Research and Development Agreement
- SBIR – Small Business Innovation Research
- In-Q-Tel – Central Intelligence Agency's VC program
- OnPoint – U.S. Army's VC program

Over the past few years, VC has been a hot topic in DoD circles. As a result, there seems to be a new VC project coming about every few months, to include this paper. The numerous VC programs currently in development or in progress make analyzing all of the programs well beyond the scope of this paper due to time constraints. As a result, the six programs listed above represent what we feel are the best examples of VC models which could provide the most benefit to the Navy. The purpose of this chapter is not to recommend an alternative to the Navy, but rather to inform the reader of what we feel are successful models.

A. U.S. NAVY COMMERCIAL TECHNOLOGY TRANSITION OFFICE (CTTO) OVERVIEW[62]

The Commercial Technology Transition Office was established in 1999 by the Assistant Secretary of the Navy (Research, Development and Acquisition) as a way to quickly insert commercial technology into the DoN to meet urgent needs. Since its inception, CTTO has brokered over 57 technology transition deals totaling $212 million that either expanded naval capabilities or reduced total ownership costs of current

[62] WindyJoy Springs, personal interview, May 2005.

All data on the CTTO comes from interviews conducted with Ms. WindyJoy Springs or the CTTO's webpage. The below graphic is adopted from the DoD FMR 5000 series.

programs. In addition to the technology transition, CTTO has also interfaced with the VC community, provided independent system oriented technology assessments, aided the DoN on technology insertion strategies and evaluated disruptive technology.

While the CTTO has a large mission, for the purposes of this paper, we will focus on its ability to transition technology into the Navy since that is one of the reasons the Navy is interested in VC. The CTTO specifically looks for technology that meets the requirements to be classified at Technology Readiness Level (TRL) of 6 or greater. [63] This means that the technology being evaluated must be at least a prototype that has been tested in an operational environment. (A summary of TRLs are provided in Table 1)

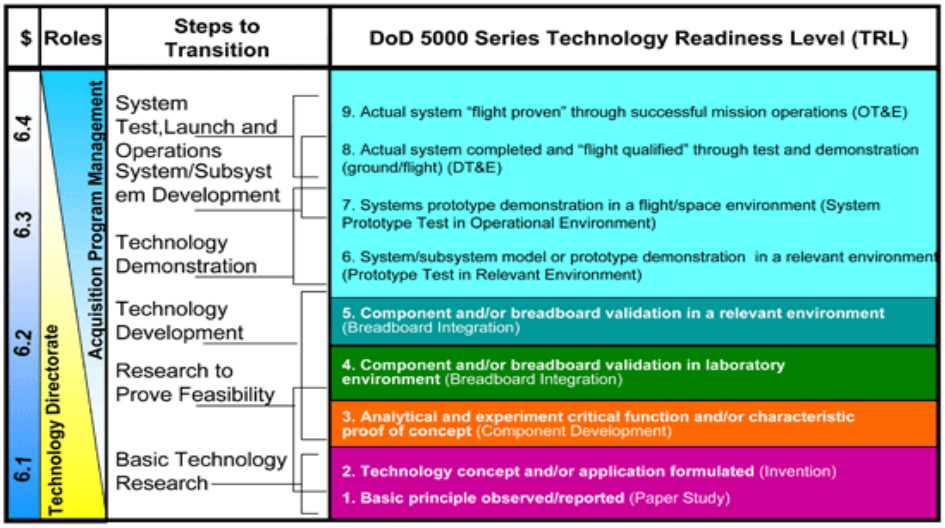

Table 1. Technology Readiness Levels[64]

When looking for technology, the CTTO narrows its search to focus on technology that will either increase the DoN capabilities or provide considerable cost savings to the DoN. CTTO identifies this technology by accepting proposals from the Program Executive Offices (PEOs)/ System Commands (SYSCOMS) and then distributing the requirements though data calls at DoDtechmatch.com. DoDtechmatch.com is a website designed to facilitate information flow between DoD activities and industry. Before evaluating any technology proposals in depth, the CTTO must have creditable information about the company's projects. Once the credibility has

[63] TRLs are stages of a product's development that correspond to its readiness for use

[64] Graphic from CTTO Website: http://www.onr.navy.mil/ctto/naval_needs.asp

been established, the CTTO acts as a matchmaker between the PEOs / SYSCOMS and the commercial sector. Figure 8 illustrates this process.[65]

Figure 8. CTTO Deal Process

When the CTTO is acting as a matchmaker, many of the technologies it identifies are not considered ready-to-field products that have been proven though actual operational use. Because of this, the CTTO may be required to provide additional R&D funding to allow the technology to be integrated into the Navy. When additional funding is required, the CTTO will establish a Memorandum of Agreement which is signed by the PEO / SYSCOM, the Resource Sponsor and the Deputy Assistant Secretary of the Navy (RDT&E). This memo verifies the cost, schedule performance and risk of the project. When this is completed, funding will be provided to the program manager to allow the deal to be executed. Typical deals are funded between $500,000 and $2,000,000.

While the CTTO's mission has expanded since its inception, its funding has not. During its first year of operation (FY99), the CTTO was funded at approximately $5 million and had approximately 12 people working in the office. In FY01, the funding was reduced to approximately $4 million and the number of employees was reduced to eight. In 2003, the FY04 budget was again reduced, to approximately $1 million, and the number of personnel was reduced to four.[66] The significant funding reductions have drastically reduced the CTTO's ability to accomplish its mission and have eliminated one of the CTTO's best tools for engaging with the VC community: the VCs@Sea program.

[65] Graphic from CTTO Website: http://www.onr.navy.mil/ctto/mission.asp

[66] WindyJoy Springs, personal interview, August 2005

1. VCs@Sea Program

The VCs@Sea program was one way the CTTO was able to interact with the VC community. The first of these events was held between 19 – 21 January 2003. Under this program, the CTTO flew a group of venture capitalists to the USS NIMITZ (CVN 65) aboard a C-2A Greyhound to observe firsthand how the Navy operates. The program included a "trap" or landing on the carrier and a "cat shot" or take off from the carrier in addition to letting the venture capitalists see a fleet command center in operation. The overall goal was to allow the venture capitalists to see "commercial uses for Naval intellectual property and spin-ins to bring commercial technology to the Navy and Marine Corps."[67]

What was noteworthy about the VCs@Sea program is that it provided a reason for the VC community to start a dialogue with the Navy. The ability for the investors, who were looking for a market for their projects, to see possible naval applications was a unique way of doing business. Historically, the Navy would submit a request for a capabilities gap which needed to be met. The VCs@Sea program approached this problem differently by inviting people to the fleet and asking "How can your company help us do our job better?" This was a significant change from the way business was normally conducted and was a new way to start dialogue with the VC community.

2. Navy Research Advisory Committee (NRAC) Venture Capital Panel

In addition to the VCs@Sea program, the CTTO was also the sponsor of the Navy Research Advisory Committee (NRAC) Venture Capital Technology Panel. The NRAC VC Panel was to meet semiannually and to exist for a two year period. The objective was to identify emerging technologies that the Department of the Navy should incorporate into its future technology plan by engaging in discussions with leading venture

67 "Venture Capitalists at Sea," Office of Naval Resarch Media Area, 5 Feb. 2003, Department of the Navy, 19 Aug. 2005 <http://www.onr.navy.mil>.

capitalists. The NRAC VC Panel was a formal mechanism that allowed the Navy to identify technology instead of establishing a VC fund such as the CIA's In-Q-Tel or the Army's OnPoint funds.

Conceptually, the NRAC VC panel fit nicely into the CTTO's objectives of identifying up and coming technology. Whereas VC funds such as OnPoint and In-Q-Tel invest heavily into specific technologies to identify a "winner", the CTTO's objective was one of awareness. They were less concerned about which individual firm's technology would prevail but instead, about what firms were developing what technology. This information was then incorporated into the Navy's technology strategy.

This, coupled with the VC@Sea Program, demonstrates an important use of VC to DoN: technology awareness. The CTTO established a system that does not invest in companies, but provides funding for technologies that it identified as meeting a DoN need. CTTO has targeted VC firms because of their success in demonstrating and fielding new technologies.

B. COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT (CRADA) PROGRAM

CRADAs are legal agreements between a federal laboratory and a non-federal laboratory that permit both parties to conduct research or develop programs that are in keeping with the federal laboratory's mission.[68] CRADAs are authorized as a result of the federal Technology Transfer Act of 1986 which permits Government operated federal laboratories to enter into CRADAs with other agencies, be it federal, state, or local governments, private industry, public and private foundations, not for profit organizations, consortiums, foreign organizations or other persons.[69] The goal of a CRADA is to allow a federal laboratory the opportunity to work with the public sector as

[68] United States, US House of Represenatives, Title 15 United States Code 3710a(d)(1), Washington, DC, 2005.

[69] Don Fuqua, United States, Cong. House, Federal Technology Transfer Act of 1986, 99th Cong., HR 3773, 20 Oct. 1986, 15 Aug. 2005 <http://www.thomas.loc.gov>.

a means to turn government technology into commercial products[70]. CRADAs can also be used to turn commercial technology into viable products for the federal government.

Like VC firms, CRADAs use the principal of leverage as a means to increase resources to solve a problem. With CRADAs, the non-federal partners have the opportunity to leverage themselves with the federal government. Either side can contribute personnel, services, equipment, funds, intellectual property or other resources that are required.[71] While CRADAs allow for joint development of programs, they are not procurement contracts and as such, are not affected by the Federal Acquisition Regulations (FARs).[72]

1. CRADAs as a Means of Technology Transfer

Even though CRADAs are designed as a tool to allow the private sector to have access to the federal government's research programs, we feel the biggest benefit of CRADAs to the Navy is the ability to have access to commercial technology. In this sense, CRADAs can be powerful tools to allow the Navy to see what the commercial sector is developing and then share in the technology. CRADAs can also have a much broader scope than a direct equity fund such as In-Q-Tel or OnPoint because the Navy would not be limiting the technology to a specific industry.

By using CRADAs, the Navy should be able to access the VC community by allowing testing of the VC firm's technology in Navy laboratories or allowing Navy personnel to have access to the VC firm's testing facilities. The Navy could exercise a certain degree of control in the testing by having its own personnel contribute to the project. This process may also give the Navy the ability to influence the technology by identifying the Navy's needs to the VC firm.

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70 Vicki L. John, Department of Defense and Industry - A Healthy Alliance, diss., Naval Postgraduate School, 2001.

71 "3710a. Cooperative research and development agreements," Cornell university Legal Information Institute (2005), 22 Aug. 2005 <http://straylight.law.cornell.edu>.

72 Vicki L. John, Department of Defense and Industry - A Healthy Alliance, diss., Naval Postgraduate School, 2001.

Conceptually, this seems like a plausible scenario for the Navy and the VC community. The difficulty comes from the Navy's need to identify the technology in the VC community before engaging in joint testing and development. It is at this point where the CRADA model runs into difficulty. There must still be a mechanism that allows the Navy a means to identify promising technology before entering a CRADA.

We also feel that the VC community may be reluctant to enter into a CRADA with the Navy. In our research with venture capitalists, many have addressed concerns about allowing information about the technology they are developing to get out. While CRADAs protect intellectual property rights for the non-federal partners, it may still be hard to convince venture capitalists of this. Previous research done on CRADAs confirms this by concluding that intellectual property rights are often the biggest hurdle to CRADAs being completed.[73]

Aside from intellectual property rights, CRADAs have other problems that must be overcome. An example is the domestic manufacturing requirements that are normally included. With the current global perspective that most high technology firms take, any restrictions placed on development can pose a challenge.[74]

The final hurdle that we will address is the patenting implications that come with CRADAs. It is not unusual for technology developed in a CRADA to require patent protection before it is further developed for the commercial sector. While there have been legislative provisions to allow for this to happen in such a way that both parties benefit, this can be something that the VC firms would rather not deal with. Much like intellectual property rights, the VC firms would rather have exclusive rights to the technology.[75] While CRADAs do not prevent this, the issue can complicate matters for the venture capitalist.

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73 Vicki L. John, Department of Defense and Industry - A Healthy Alliance, diss., Naval Postgraduate School, 2001.

74 Ibid.

75 Vicki L. John, Department of Defense and Industry - A Healthy Alliance, diss., Naval Postgraduate School, 2001.

C. SMALL BUSINESS INNOVATION RESEARCH (SBIR) PROGRAM

Arguably two of the most successful "venture" initiatives the government has undertaken are the Small Business Innovation Research (SBIR) program and the Small Business Technology Transfer (STTR) program.[76] The SBIR program makes capital available, in the form of grants, to small businesses in the earliest stages of technology development. The focus of the program is only on new technology. The STTR program is a partnership program that helps facilitate research agreements between small businesses and not-for-profit or government contracted research facilities. A STTR criterion for award is similar to SBIR.

Every federal agency that receives a research and development budget of $100 million or more is required to establish and operate a SBIR program. The participating agencies are required to set aside 2 ½ percent of their appropriated R&D budgets for the program. Each agency administers its own program with the Small Business Administration taking an oversight role issuing directives and reports. As of fiscal year 2004, there were 12 federal agencies participating in the program with the DoD being the largest contributor. Other participating agencies include the Departments of Agriculture, Commerce, Education, Energy, Health and Human Services, Homeland Security, Housing and Urban Development, and Transportation; the Environmental Protection Agency, the National Aeronautics and Space Administration, and the National Science Foundation.

The SBIR program is administered in three phases. Phase I allows awards of up to $100,000 and is designed to determine the feasibility and scientific merit of the proposed research. In addition, the quality of the performance of the awarded company will be reviewed. Phase I typically lasts no longer than six months. Phase II allows further research and development of the idea and grants awards of up to $750,000 for two years. Phase II also includes a study on and a review of the commercialization of the technology. Phase III is the commercialization stage. Of note is that only Phase I awardees are eligible for subsequent awards. Here the company must seek capital from

[76] Although this literature review will focus mainly on SBIR, many inferences can be made to STTR.

non-government sources. Commercialization funding is prohibited by law, but participating agencies may continue to fund promising R&D with non-SBIR funding and may award procurement contracts for products developed in previous phases.[77]

As will be discussed later in this section, one of the goals of the SBIR program is to stimulate innovation and commercialization of technologies by small businesses, particularly minority and disadvantaged businesses. To accomplish this, the program is restricted to independently owned and operated for-profit organizations consisting of not more than 500 employees. If the company is publicly-owned, at least 51% of the company must be owned by United States citizens or lawfully admitted permanent residents. The company's principal place of business must be located inside the United States.

Since its inception in 1982, the SBIR program has dispersed over $18 billion dollars in awards. There have been nearly 65,000 Phase I awards and 22,000 Phase II awards. These awards have produced over 47,000 patents.[78] Some prior companies that have received awards while privately held include Apple Computer, Chiron, Compaq, Federal Express, and Intel.[79] The 2005 award pool is approximately $2 billion dollars and currently has over 6,000 active awards.[80]

1. Evolution of SBIR

Congress designated four main goals for SBIR; established by the Small Business Innovation Development Act of 1982,

1. To stimulate mission-related technological innovation
2. Use small businesses to meet federal R&D needs

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[77] "Small Business Innovation Research Program," SBA Technology, Small Business Association, 15 Aug. 2005 <http://www.sba.gov>.

[78] Ann Eskesen, "SBIR Basics," In Know-Vation, Innovation Development Institue, 15 Aug. 2005 <http://www.inknowvation.com>.

[79] Josh Lerner, "The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program," Harvard University and National Bureau of Economic Research (1998).

[80] Ann Eskesen, "SBIR Basics," In Know-Vation, Innovation Development Institue, 15 Aug. 2005 <http://www.inknowvation.com>.

3. Foster participation by minority and disadvantaged persons in technological innovation
4. Increase private sector commercialization of innovations derived from federal R&D.[81]

In 1986, the six year law was granted an extension and the original expiration was moved from 1988 to 1993.[82] In 1992, the law was reauthorized under the Small Business Research and Development Enhancement Act. The purpose of this law was to:

1. Expand and improve the SBIR program
2. Emphasize the goal of increasing private sector commercialization
3. Increase small business participation in federal R&D
4. Improve dissemination of information on the SBIR program[83]

This new act also provided for an increase in awards in both Phases I and II, as well as providing for subsequent inflation adjustments and program changes.

The latest reauthorization took place in 2000 under the Consolidated Appropriations Act of 2001. The current law requires the Small Business Administration and participating agencies to:

1. Expand the Scope of publicly available knowledge on grants
2. Report annually on their programs[84]

In addition, the law requires awardees to provide information to the SBA to help them evaluate the program. The current law is due to expire in 2008.

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[81] Warren Rudman, United States, Cong., Small Business Innovation Development Act of 1982, 97 Cong., 219, 23 Jun 1982, 22 Aug. 2005 <http://www.thomas.loc.gov>.

[82] Nicholas Mavroules, United States, Cong., A bill to provide the Small Business Administration continuing authority to administer a program for small innovative firms, 99 Cong., 443, 6 Oct. 1986, 22 Aug. 2005 <http://www.thomas.loc.gov>.

[83] Warren Rudman, United States, Cong., Small Business Technology Transfer Act of 1992, 102 Cong., 564, 3 Oct. 1992, 22 Aug. 2005 <http://www.thomas.loc.gov>.

[84] John E. Porter, United States, Cong., Small Business Reauthorization Act of 2000, 106 Cong., 554, 15 Dec. 2000, 22 Aug. 2005 <http://www.thomas.loc>.

2. DoD and Navy Involvement in SBIR

Since DoD is the recipient of the largest Research and Development Budget, it is also the largest contributor to the program. The DoD SBIR budget for FY2005 is approximately $1.08 Billion. This accounts for 53.5% of the total federal SBIR program (Figure 9).[85] The goal of DoD's SBIR program is to "harness the innovative talents of the nation's small technology companies for U.S. military and economic strength."[86] To meet this goal, DoD's SBIR program focuses on companies that are researching early-stage topics that serve DoD or component needs and that have commercialization or military market value.

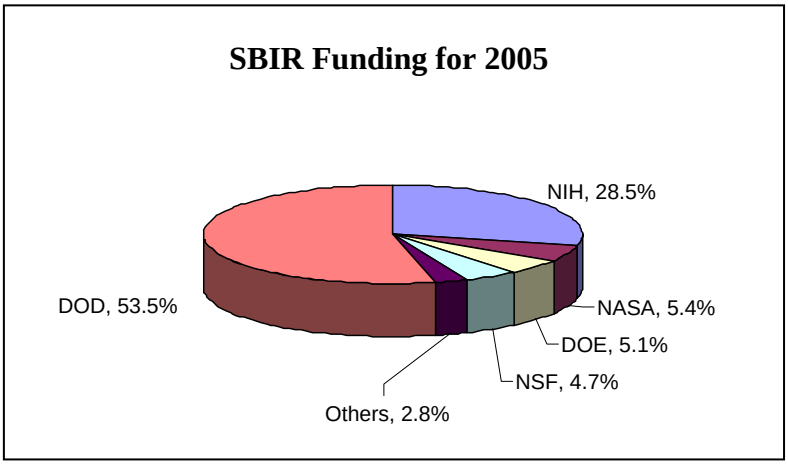

Figure 9. SIBR Funding in 2005

Surveys conducted by DoD have shown 35% of companies have commercialized products or services directly related to SBIR funding.[87] In addition, 45% of the projects have gone on to receive additional developmental funding through private means or in the form of Phase III contracts. Per the law, DoD sets aside no more than the required 2.5% of its RDT&E budget for SBIR. Nearly 20% of annual awards go to minority and

[85] "Small Business Innovation Research, Small Business Technology Transfer, and Fast Track," Acqusitiion, Technology, and Logistics, 22 Sept. 2005, Department of Defense, 30 Oct. 2005 <http://www.acq.osd.mil>.

[86] "Small Business Innovation Research, Small Business Technology Transfer, and Fast Track," Acqusitiion, Technology, and Logistics, 22 Sept. 2005, Department of Defense, 30 Oct. 2005 <http://www.acq.osd.mil>.

[87] United States, Government Accountability Office, Congress, Observations on the Small Business Innovation Research Program, GAO-05-86IT, June 2005, 15 Aug. 2005 <http://gao.gov>.

women owned businesses. A significant number of companies that receive Phase I awards have only 2-9 employees (28.8%). Only 15% of companies receiving awards have over 100 employees. Nearly 1/3 of awards are given to first time SBIR companies.

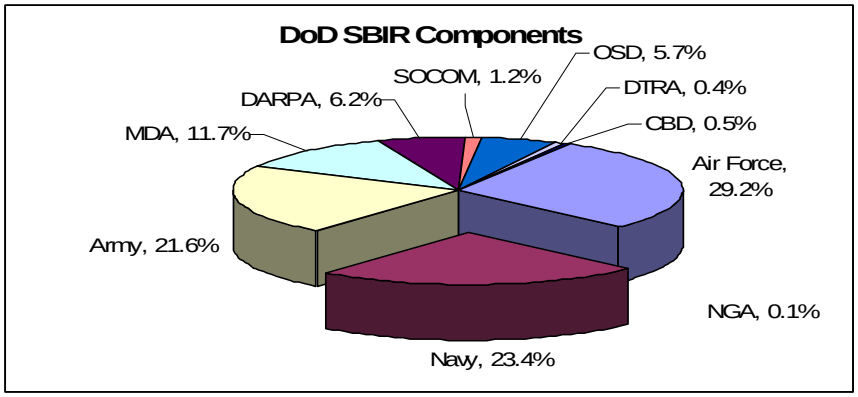

Figure 10. DoD SBIR Component Contributions FY 2005

The Navy's SBIR program matches closely with DoDs. The Navy is the second largest investor in SBIR in the DoD at approximately $252 Million (Figure 10). The DoN's SBIR program is designed to be "mission oriented" and provide opportunities for small businesses to become part of the national technology base providing research and technology to the military and commercial sector. Its goal is to transfer technology from small businesses to active naval programs and systems.[88]

Like DoD and other participating agencies, the Navy publishes a semi-annual solicitation describing research topics and issues in which it is interested. It requests small businesses to propose research and development projects that will meet these needs, but that also have the potential for commercial development. The proposals are judged on their scientific merit and technical feasibility. The Navy measures success of its SBIR program by what technology is transferred into the fleet in the forms of products, tools, or services that benefit the acquisition community. In 2003, the DoN had the highest rate of returning technology to the military of any DoD component.[89] The

[88] "Department of the Navy SBIR/STTR Success Stories," Small Business Innovation Research, Department of the Navy, 22 Aug. 2005 <http://www.navysbir.com>.

[89] Ibid

Navy invested 23.4% of the DoD's overall SBIR contribution and accounted for 81% of the Phase III funding in the form of acquisition and purchasing contracts as well as funding for further development.

3. How SIBR Helps Innovation and Small Business

SIBR can, in some way, be credited with helping to develop technology and innovations that have resulted in over 47,000 patents. That works out to a rate of one patent every 4 to 5 hours over the life of the program. According to the Innovation Development Institution, nearly 400,000 graduate engineers and scientists work with or for SBIR funded companies. That works out to be nearly three times the amount working in academia in the United States.[90] All agencies involved have praised the results of the program and credit it with useful research and development for their agencies. A 1989 GAO report indicated that agencies reported that 75% of the research conducted under SBIR was as good as or better than other agency-funded research. The report went on to say that some agency officials said the SBIR research was more likely than other research they oversaw to have success in invention and commercialization.[91]

SBIR helps small high-technology based companies gain access to funding for research and development for high-risk concepts. Typically, these companies may consist of a few or even one person with little or no capital. Since the idea is not proven, there is high business risk. The company also has high financial risk because it has little or no capital. This unfortunate combination means that traditional lenders and investors (including Venture Capitalists) may not be interested in such a high risk venture. Since 1982, only about 7% of SIBR companies have been VC backed.[92]

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[90] Ann Eskesen, United States, Cong. House, Testimony to the House Subcommittee on Environment, Technology, and Standards, 109th Cong., 1st sess., HR 2943, 28 Jun. 2005, 15 Aug. 2005 <http://www.house.gov>.

[91] United States, United States Congress, Government Accountability Office, Proposed Amendments to the Small Business Innovation Research Program, 30 Jun 1989, June 2005 <http://www.gao.gov>.

[92] Ann Eskesen, United States, Cong. House, Testimony to the House Subcommittee on Environment, Technology, and Standards, 109th Cong., 1st sess., HR 2943, 28 June 2005, 15 Aug. 2005 <http://www.house.gov>.

Besides helping companies obtain government funding, SBIR may also help companies attract non-government investors. In 1998, Josh Lerner conducted a study comparing SBIR backed companies to comparable companies developing similar technologies that were not SBIR funded. He found that SBIR awardees typically had substantially greater employment and sales growth over the non-SBIR funded companies.[93]

Because of the competitive process of SBIR, being an awardee may signal creditability of a company to external markets and investors. As noted earlier, selection for the program is based on scientific merit and technical feasibility. Each agency has its own selection criteria and boards that conduct thorough reviews on each proposal. The reviews are conducted by scientists and engineers who understand the needs of their agencies and are fully qualified to make these determinations. The selection for an award is highly competitive. Typical selection results are one Phase I award for every ten submitted. Of those Phase I awards, only about 1/3 go on to receive Phase II funding. Typically the major limitation is funding. Several agencies noted that many proposals were deemed qualified, but lacked the funding to award multiple proposals for the same research topic.[94]

The certification that is signaled by a successful SBIR company is critical to the commercialization of products and services. An important issue that must be kept in mind is that most small technology firms that are attracted to SBIR funding are not "full-system builders."[95] The market and public sector want a complete product. These companies are best suited for developing a concept into a technology and then require assistance to commercialize their idea. Since the only real Phase III funding is in the form of contract awards, it is fully dependent on the company to acquire non-government investment to transition the technology to the market. Lerner goes on to suggest that "a

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[93] Josh Lerner, "The Government as Venture Capitalist: The Long-Run Impact of the SBIR program," Harvard University and National Bureau of Economic Research (1998).

[94] United States, Government Accountability Office, Congress, Observations on the Small Business Innovation Research Program, GAO-05-86IT, June 2005, 15 Aug. 2005 <http://gao.gov>.

[95] Ann Eskesen, United States, Cong. House, Testimony to the House Subcommittee on Environment, Technology, and Standards, 109th Cong., 1st sess., HR 2943, 28 June 2005, 15 Aug. 2005 <http://www.house.gov>.

key benefit of SBIR awards is the certification that they provide, it might be possible that a program that offered much more modest subsidies could also be effective in certifying the quality—and spurring the growth—of small high technology firms."[96]

4. Venture Capital and SBIR

VC backed companies have been involved in the SBIR program since its inception. To qualify for a SBIR grant, there must be the potential for commercialization of the product. The program is not designed to bring a technology from its inception to the shelf. Most companies do not have the business acumen to accomplish this. This is where the expertise of VC can play a crucial role.

The government can gain enormous benefit from leveraging its invested dollars with the commercial sector to develop needed technology. For example, since the program's inception, 607 VC backed companies have been awarded nearly 5,000 grants that have produced 7,138 patents. Of these 607 companies 228 have achieved a liquidity event (211 have gone public and 17 acquired post Initial Public Offering (IPO)). The market value of these companies is estimated at $45-50 billion with VC investment totaling $4.5 billion. The total SBIR investment in these firms was $790 million.[97] SBIR participation creates value in a company that can help it transition from a start-up to a viable business.

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[96] Josh Lerner, "The Government as Venture Capitalist: The Long-Run Impact of the SBIR program," Harvard University and National Bureau of Economic Research (1998).

[97] Ann Eskesen, United States, Cong. House, Testimony to the House Subcommittee on Environment, Technology, and Standards, 109th Cong., 1st sess., HR 2943, 28 June 2005, 15 Aug. 2005 <http://www.house.gov>.

5. 51% Rule Debate

Currently, there are bills before the House and the Senate that would relax the regulation concerning ownership of SBIR eligible companies.[98] This has sparked a huge debate on whether this is beneficial to the program. The bills before Congress would remove the "individual" clause and allow for majority VC backed ownership of a company to compete for SBIR grants. The ruling would not change the size restrictions on companies participating in the program.

An SBA ruling in 2001 determined that the "majority owned by U.S. citizens" requirement should be interpreted literally as an individual person, as opposed to an entity.[99] The ruling was upheld in another challenge in 2003. This debate seems to mostly focus on the bio-tech firms that apply for the National Institute of Health SBIR grants. Other agencies (including DoD) have chosen to ignore the rule. SBA is currently holding hearings and debates on the issue and proposes to have a decision by the end of the year. However, a vote in the Congress could make the effort futile.

D. IN-Q-TEL: THE CENTRAL INTELLIGENCE AGENCY'S INITIATIVE

The most talked about government VC initiative, the Central Intelligence Agency's (CIA) In-Q-Tel program can be credited with spurring the government's recent VC interest. In the mid 1990's, the CIA realized that it could not keep pace with the commercial sector innovations that were coming about. The government research and development programs that were the envy of the world in the mid 20th century and had produced such projects such as the U-2 and SR-71 were no longer leading the way. The CIA was no longer at the forefront of technology.

As a result of this paradigm shift, senior leadership in the CIA started thinking about how the CIA could regain some of the lost ground. They were not necessarily

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[98] Christopher Bond, United States, Cong. Senate, Save America's Biotechnology Innovative Research Act of 2005, 109th Cong., 1st sess., 1263, 16 June 2005, 30 Oct. 2005 <http://www.thomas.loc.gov>.

[99] Penni Crabtree, "Showdown on Grants; Venture-capital-controlled companies pressure SBA for slice of pie," San Diego Union-Tibune 17 Jun 2005.

looking for ways to fund new top secret projects, but were looking for ways to solve what seemed to be an ever increasing number of problems that were presenting themselves. One of the biggest problems was information overload from all of the various intelligence gathering sources the CIA used. By one estimate, at this time, the CIA and National Security Agency (NSA) were receiving enough information to fill the Library of Congress every three hours. This information was coming from all over the world, in different languages, formats, and types of media.[100]

With the information management problem defined, senior leadership started to take action. In 1998, the director of the CIA, George Tenet, launched the "Strategic Direction" initiative. Included in this initiative was the following:

> Beginning with the critical field of IT, we will pursue this [new] approach through the creation of an external non profit enterprise designed to be electronically connected to leading research throughout the country. This new entity will speed insertion of mature technologies, support rapid development of mission critical applications and enhance our ability to attract the skills and expertise vital to our success.[101].

In order to carry out the director's mission, the CIA started to assemble a special team that would create this new entity. To assist with the development of the organization, the CIA hired Arthur Andersen LLP and the law firm Arnold and Porter. Together with these firms and the CIA's in-house personnel, the mission was undertaken.[102]

It was determined by the Deputy Director of Science and Technology that this new organization would have to be quick to react while also being able to address the CIA's complex challenges. As a result of this, the CIA team focused on four existing models which could interact with the government and fund research as baselines to create their own programs:[103]

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[100] "In-Q-Tel Corporate Overview," In-Q-Tel, 2003, Central Intelligence Agency, 1 Aug. 2005 <http://www.in-q-tel.org>.

[101] "Accelerating the Acquisition and implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

[102] Ibid

[103] Ibid.

- Federally Funded Research and Development Centers (FFRDCs)
- Defense Advanced Research Projects Agency (DARPA) /Advanced Concepts Technology Demonstration (ACTD)
- Research Laboratories
- Venture Capital

FFRDCs are research centers funded by the government but administered by universities or other non-profit entities. FFRDCs are prohibited from manufacturing products which they helped create so they do not compete with private sector companies and are privy to private research that would otherwise not be divulged. While FFRDCs research a wide variety of technologies, they are also subject to more bureaucratic oversight which limits their agility.

DARPA / ACTD focus on high end specialized technology for the military. These organizations are not concerned with commercial applications of their research but instead fund projects that are designed to be cutting edge with military benefit. They will often overlook projects that are being developed with other's interest in mind because if the technology is for others, it loses its strategic military benefit.

Research laboratories encompass a much broader category and can be classified as corporate, government, or independent. They normally receive funding from an outside organization that may or may not have a say in the way the funding is to be used. The organization which provides the funding will usually stipulate how the research will be used. Most research laboratories are established as "in house" entities that do research for a related organization.

While the above models could deal with the insertion of technology into the CIA, they were rejected because it was determined that they could not keep pace with the speed of technology transition that the CIA needed.[104] As a result, the CIA started to look at the VC industry. Conceptually, the VC industry's goals were closely tied to that of the CIA.

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[104] "Accelerating the Aquisition and implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

First, the VC firms funded projects which they hoped would have commercial applications, meaning that they solved a problem. The VC industry was also segmented around specific technologies. This meant that the CIA could design a program which focused on its needs, not on a general area of technology. The VC industry was also at the forefront of the IT industry.

Even with all of this going in the VC model's favor, when looking at the VC industry, the CIA's team still did not find a model that perfectly fit the requirements that the CIA set forth. The main reason seems to stem from the fact that VC firms are in the business to make money for the investors, not develop technology. Even so, it was determined that the VC models still held promise due to their ability to identify technology and then rapidly insert it into the commercial sector. When analyzing the VC industry, the team realized that there were many innovations coming from this sector that had little government visibility.[105]

After analyzing the government R&D models and the VC industry, it was determined that the CIA could create a hybrid model that would incorporate the best of both worlds. In 1999, Peleus Inc. was established as the CIA's model. The name was later changed to In-Q-IT to highlight the IT focus before finally being changed to In-Q-Tel.[106] The mission of this new organization was to "deliver leading-edge capabilities to the CIA and intelligence communities by investing in the development of promising technology."[107]

1. The In-Q-Tel Venture Capital Model

In-Q-Tel was unique because it combined many different models into one that was determined would best fit the CIA's needs. The In-Q-Tel model has incorporated aspects of the corporate VC industry, traditional business, non-profit business and

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[105] Stephen F. Mendel, Personal interview. 25 Jul 2005.

[106] "Accelerating the Aquisition and implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

[107] "In-Q-Tel - About Us," In-Q-Tel, 2003, Central Intelligence Agency, 18 Jul 2005 <http://www.in-q-tel.org>.

government R&D models. The CIA argues that this mix is exactly what it needs to solve its IT problems. The uniqueness of the In-Q-Tel model stems from the fact that by definition, most of In-Q-Tel's goals seem to be incompatible. Simply put, the CIA wants access to new technology at a relatively low price and wants the technology quickly. Under normal government contracting, you can have only two of these at the expense of the third.[108] In-Q-Tel is trying to balance all three and uses the VC industry as a good proxy on how to do this.

As opposed to being solely based on a VC model, In-Q-Tel uses the VC model as a tool to gain access to technology. By using the VC model, In-Q-Tel makes equity investments into firms with promising technology and takes stakes in those companies. Most of the money that In-Q-Tel invests is dedicated to R&D with the hopes of speeding the development of products to the CIA and other intelligence communities. In-Q-Tel sees itself as a technology accelerator with the money invested being used to bring the product to the market quicker.

The equity investments bring many other benefits to In-Q-Tel as well. First, they make it so technology firms seek out In-Q-Tel, not the other way around. A benefit to this is that it brings the CIA access to a largely untapped market.[109] Equity investments also allow In-Q-Tel to have a position on the board of directors. This seat on the board allows In-Q-Tel to develop relationships with the firms it invests in and have unrestricted visibility into the firms' products that are being developing.[110]

The third benefit that equity investments bring is they allow In-Q-Tel to share the cost of development of new products. While the CIA is In-Q-Tel's sole source of funding, In-Q-Tel makes investments with other VC firms as a way to spread the risk. By doing this, In-Q-Tel (or the CIA) does not have to bear the full burden of funding a project.

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[108] Gregory K. Mislick, "Cost Estimation OA 4702," Naval Post Graduate School, Monterey, CA, 15 Aug. 2005.

[109] Stephen F. Mendel, Personal interview. 25 Jul 2005.

[110] "In-Q-Tel - About Us," In-Q-Tel, 2003, Central Intelligence Agency, 18 Jul 2005 <http://www.in-q-tel.org>.

The fourth benefit of this type of investing is that smaller investments allow In-Q-Tel to make more investments. The typical In-Q-Tel investment is between $1 million and $3 million dollars.[111] More investments mean that there may be more technologies that In-Q-Tel can identify and develop for the CIA. This in-turn, allows In-Q-Tel to diversify. Along with this, if In-Q-Tel's investments become profitable, In-Q-Tel is able to take a share of the returns and reinvest them in other projects. The greater the return, the less the CIA will need to invest in later years in order to still have a constant flow of new technology.

The final benefit that the VC model brings is that it allows In-Q-Tel to operate outside of any government or bureaucratic constraints that are placed on a government agency. In-Q-Tel can obligate money in any year it wishes. It is not required to comply with the Federal Acquisition regulations and is not restricted by the civil service personnel policy. All of these traits give In-Q-Tel added flexibility.

2. Customer Focus

While In-Q-Tel is run like a VC firm, it is important to remember that it is in business to provide the CIA with rapid technology transition to solve emerging problems. While In-Q-Tel acts like a VC, it differs from a traditional VC in many ways. First, In-Q-Tel's goal is to develop technology, not generate financial returns for its investors.[112] There is an inherent conflict present when the industry's performance metrics and In-Q-Tel's performance metrics differ and our research indicates this as one reason many VC firms question In-Q-Tel's business plan.

Another difference which is related to performance measurement is that In-Q-Tel's investments are structured to generate value beyond cash. Each investment In-Q-

111 "In-Q-Tel Corporate Overview," In-Q-Tel, 2003, Central Intelligence Agency, 1 Aug. 2005 <http://www.in-q-tel.org>.

112 "Accelerating the Aquisition and Implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

Tel makes is done with the hope that the investment will generate a product for the CIA. These products may provide returns in the form of National Security of which no direct correlation will ever be made.

The final difference that will be addressed is that In-Q-Tel may forgo profitable investments if they are not in keeping with the CIA's needs because the CIA is its primary customer. Whereas a traditional VC firm will almost always make an investment in an industry where it operates if it thinks it will generate a significant return, In-Q-Tel is focused on the CIA's needs.[113]

Although In-Q-Tel is focused on the CIA, it is also looking long term. The best situation for In-Q-Tel would be to invest in a firm that not only meets the CIA's needs but has the possibility of becoming self sustaining.[114] Here is an example of In-Q-Tel balancing its customer's needs within the bounds of a VC model.

3. In-Q-Tel Interface Center (QIC)

One of the most unique aspects of the In-Q-Tel model relates to how In-Q-Tel is able to interact with its customer, the CIA. Although In-Q-Tel was chartered for the specific purpose of transitioning technology to the CIA, it was recognized early on that both parties would need to have a clear understanding of the other's needs and capabilities. In order to facilitate communication between the CIA and In-Q-Tel, In-Q-Tel created the In-Q-Tel interface center or QIC for short. The mission of the QIC is to "link the CIA and In-Q-Tel to ensure identification, development, transition and acceptance of unique value added commercially viable IT solutions that address the CIA's critical needs.[115]" Simply put, the QIC is the middleman between the CIA and In-Q-Tel.

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[113] "Accelerating the Aquisition and Implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

[114] Stephen F. Mendel, Personal interview. 25 Jul 2005.

[115] "Accelerating the Aquisition and Implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

The QIC is staffed with full time CIA officers who are solely dedicated to working with In-Q-Tel. The members of the QIC possess an inside knowledge of the CIA and its operations, while also possessing the security clearances necessary to communicate between the CIA and In-Q-Tel.[116] The independent report on In-Q-Tel conducted by the Business Executives for National Security (BENS) for Congress suggests that the way the CIA staffs the QIC is the reason it is so successful.[117]

The BENS report states that the QIC is primarily composed of people with one of two specialties: IT background or significant CIA experience. While there is some debate as to how many of each group should be represented in the QIC, the BENS report notes that both specialties are equally needed. In order to identify current problems in the CIA, personnel with significant CIA experience are needed to navigate the bureaucracy and communicate the problems to In-Q-Tel. At the same time, the QIC needs experts in IT who can communicate In-Q-Tel's findings back to the CIA and show the CIA how the technology fills a need.[118]

As the In-Q-Tel model has evolved, so have the QIC's responsibilities. Aside from just being the middleman, the QIC's role has expanded to include oversight and administrative duties.[119] The fact that an organization designed to assist In-Q-Tel is performing administrative as well as oversight duties initially caused some concern because it appeared that there could be conflicts of interest in the QIC responsibilities. After discussing the QIC role with In-Q-Tel though, the concerns were diminished. When one thinks about the mission of In-Q-Tel and its client, it is easy to understand the oversight and administrative challenges present. Our research indicates that the QIC does a good job of managing all of its responsibilities to all parties while providing added

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116 "In-Q-Tel Corporate Overview." In-Q-Tel. Central Intelligence Agency. 1 Aug. 2005 <http://www.in-q-tel.org/news/attachments/CoporateOverview.pdf>.

117 "Accelerating the Aquisition and Implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

118 Ibid

119 Wendy Molzahn, "The CIA's In-Q-Tel Model," Acquisitiions Review Quarterly (2003), 28 Aug. 2005 <http://www.dau.mil>.

value to all organizations. We could not find any instances where conflicts of interest came to be a problem and up to this point, In-Q-Tel's success record seems to be proof that the relationship is working.[120]

4. The In-Q-Tel Process[121]

Aside from the role of the QIC, much of In-Q-Tel's success to this point can also be attributed to the In-Q-Tel Process also known as the "Q-Process". The "Q-Process" is an eight step process that starts by identifying the CIA's needs and concludes with the acquisition and deployment of fielded technology. Figure 11 gives a graphical representation of this process.

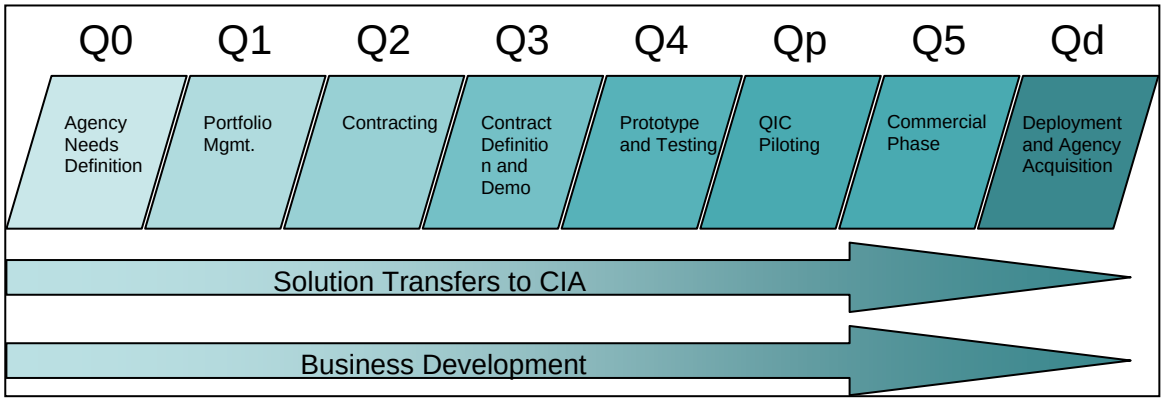

Figure 11. In-Q-Tel Business Development Progression[122]

The "Q-Process starts with Q0 where the CIA defines its needs to In-Q-Tel though the QIC. Normally, the needs are identified to the QIC though the CIA's Chief Information Officer or Advanced Technology Office. During this stage, In-Q-Tel's technology team will assist in evaluating the feasibility of the proposed problems in relation to possible solutions.

120 Later sections will go into more detail about In-Q-Tel's performance to date.

121 All data for this section comes from the BENS report on In-Q-Tel unless otherwise noted.

122 This chart is based on the In-Q-Tel "Q-Process" chart in the BENS report with modifications based on our research.

The second stage, Q1, is characterized by a three tier assessment program in which In-Q-Tel starts dialogues with prospective companies. The first part of the assessment is to review the macro-marketplace. The second tier is to investigate specific firms in more detail with the possibility of constructing a deal. The third tier is categorized as further technology research to analyze whether the proposed technology will still be of value to the CIA.

The third stage or Q2, is the portfolio management phase. In this stage, In-Q-Tel matches problems identified in Q0 to a prospective portfolio company that may present a solution. This stage goes more in depth to the contracting details such as legal requirements, financial requirements and technical expectations of the portfolio company. A contract is drafted in this stage which delineates all of the above.

The fourth stage or Q3 of the "Q-Process" is characterized by the drafting and signing of a contract between In-Q-Tel and the technology company. During this stage, the product under development is being tested and evaluated while In-Q-Tel is providing feedback to ensure the product is meeting the CIA's needs. This stage is followed by the Contract Definition and Demonstration phase.

In Q4, the product being developed is tested in unclassified scenarios that the CIA uses to evaluate the overall fit of the product. In this sense, the QIC is heavily involved in the testing. The overall goal of this stage is to test the technology before the CIA can complete its more formal tests.

The next stage or Qp, is more of an evolution of the previous phase. Here, the QIC expands its testing and allows the CIA to test the product on a limited basis. During this stage, In-Q-Tel, the QIC and the CIA all work together to refine the product to better meet the CIA's needs. This stage is followed by the Commercialization or Q5 stage.

In the Q5 Stage, In-Q-Tel analyzes a technology to identify whether it will have commercial applications beyond the CIA. If a product can be commercially viable, then it can significantly reduce the CIA total ownership costs and acquisition time frame. Here, In-Q-Tel and the QIC must walk a fine line. The CIA will benefit from any commercial applications because the economies of scale that such scope brings. At the same time, the CIA wants to make sure that the release of the technology will not

compromise and security concerns. This stage is followed by the last stage, Qb. In Qb, In-Q-Tel is focused on transition the technology to the end user. The end user can be the CIA, the commercial market or a combination.

5. Financial Perspective

When In-Q-Tel was conceived, it had almost unanimous support of senior CIA officials. This support made it easier to get the program approved and funding appropriated quickly. With the CIA being In-Q-Tel's sole source of funding, it was, and still is, imperative that the CIA continue to fund In-Q-Tel if it is to remain a viable component of the CIA's technology transfer program.

The first contract between In-Q-Tel and the CIA was in FY99 and it had a value of $28.7 million. This contract was followed by a $37.27 million contract in FY00 and a $33.00 million contract in FY01.[123] Since 2001, In-Q-Tel has been funded at approximately $35-40 million per year with over 40% of each year's funding going to investments.[124]

Due to In-Q-Tel's line of work, current funding data for our research are hard to come by. For the first year of operations in 1999, In-Q-Tel incurred start up costs of $2.5 million, selling and administrative costs of $12.6 million and annual reoccurring costs to include salaries and compensation of board members of $10.1 million.[125] Exact data after 2001 are not available to analyze current costs.

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[123] "Accelerating the Aquisition and implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

[124] Stephen F. Mendel, Personal interview. 25 Jul 2005.

[125] "Accelerating the Aquisition and implementation of New Technologies for Intelligence: The Report of the Independent Panel on the Central Intelligence Agency In-Q-Tel Venture," Business Executives for National Security (2001), 1 Aug. 2005 <http://www.bens.org>.

6. In-Q-Tel's People

In-Q-Tel has offices located in Palo Alto, CA and Arlington, VA. The Palo Alto office directs most of the VC projects and is staffed by eight people. The Arlington, VA office liaisons with the CIA and is staffed with approximately 50 people. Out of these 50 people, about half are on the technology teams while the remaining half focus on technology transfer to the CIA.[126]

A continuing challenge for In-Q-Tel is to find highly qualified personnel willing to leave successful careers in the IT or VC community and focus on national security issues. Because of this challenge, In-Q-Tel has structured an employee compensation plan that specifically targets personnel in the private sector with either IT or VC expertise.[127]

The employee compensation plan is made up of three distinct pay breakdowns. The first is a base salary paid to all employees. The base salary is benchmarked to the industry sectors where In-Q-Tel invests because it must compete with these sectors to recruit talent. The base salary is then supplemented by an annual performance bonus and long-term incentives.[128]

The annual performance bonus is based on how well In-Q-Tel and its employees perform in relation to annual goals and metrics specified at the beginning of the year. In-Q-Tel's performance is analyzed by the Board of Trustees and the CIA. Individual performance is judged by the respective employee's manager before being approved by senior management.[129]

The long-term incentive is also called the Employee Investment Fund. This fund was created as a way to link the employees of In-Q-Tel to the firms they invest in by investing a portion of each employee's compensation side-by-side with In-Q-Tel's investments. Through the Employee Investment Fund, each employee has a stake in all

126 Stephen F. Mendel, Personal interview. 25 Jul 2005.

127 "In-Q-Tel - About Us," In-Q-Tel, 2003, Central Intelligence Agency, 18 Jul 2005 <http://www.in-q-tel.org>.

128 Ibid.

129 Ibid

In-Q-Tel investments. This fund was created because as a non-profit, non-stock firm, In-Q-Tel is not able to offer compensation bonuses (options) similar to publicly traded firms. In-Q-Tel's employees do not have a say over the selection of investments or over how the proceeds will be distributed.[130]

7. In-Q-Tel's Performance

In the previous section of this paper, we discussed the life of a VC fund and when returns can be expected. Our research indicates that because In-Q-Tel makes investments as a VC, the investments have a similar life. Because of this life, only recently can one get an idea as to how well In-Q-Tel is doing and most data indicate that In-Q-Tel is doing very well.

The most recent data indicate that In-Q-Tel has reviewed 5000 business plans, invested over $100 million in 80 companies and 10 projects in university labs. Of these investments, only four have collapsed. This is an impressive record considering that a 50% failure rate is expected in its line of business.[131] In addition to the $100 million invested, In-Q-Tel has also leveraged $950 million in private sector funds to support technology being developed for the CIA.

When considering performance though, it must be clear that In-Q-Tel places technology transition before monetary profit. Along this metric, In-Q-Tel has delivered over 100 technologies to the CIA to enhance its capabilities with many more in development.[132] Most notable in these products that have been delivered is that many are

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130 "In-Q-Tel - About Us," In-Q-Tel, 2003, Central Intelligence Agency, 18 Jul 2005 <http://www.in-q-tel.org>.

131 "In-Q-Tel: The CIA's Silicon Valley Bridge," Red Herring 8 Aug. 2005, 22 Aug. 2005 <http://www.redherring.com>.

132 "In-Q-Tel - About Us," In-Q-Tel, 2003, Central Intelligence Agency, 18 Jul 2005 <http://www.in-q-tel.org>.

from firms that would have not otherwise considered working with the government.[133] In this sense, In-Q-Tel has been successful in identifying and engaging new firms that are willing to deal with the government.

The final performance issue that is starting to emerge is that there appear to be more VC firms that want to do business with In-Q-Tel. It is clear that other VC's are starting to recognize In-Q-Tel's success. In the VC industry, reputation goes a long way and In-Q-Tel is well respected. Robert Shaw, CEO of ArcSight, one of In-Q-Tel's investments, has worked with numerous VC firms and was quoted in a recent article, "I'd say In-Q-Tel is as good or better than any other VC [firm] I've worked with."[134] Instead of In-Q-Tel searching for technology companies, now technology companies are looking to In-Q-Tel. In the VC world, that is a sign of success.

E. THE ARMY VENTURE CAPITAL INITIATIVE (AVCI)

In response to the 2002 Department of Defense Appropriations Act, Section 8150 of Public Law 107-117, the Army set aside $25 million of its existing Research, Development, Test, and Evaluation (RDT&E) budget for the establishment of a not-for-profit venture capital organization. The purpose of the statute was to develop "better collaborative ties with the young, small, growth-oriented companies that take risks and push innovation."[135]

The Army worked closely with the Rand Corporation in developing the concept of using VC as a vehicle to gather information on new technologies and to expedite the transfer of products to the hands of the soldier. Bruce Held and Ike Change of Rand made a convincing argument that VC "exploits venture capital's efficiency in developing technology, its access to the growing commercial technology sector, its capacity to respond with agility to changing technology, and its ability to leverage additional

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133 "In-Q-Tel Corporate Overview," In-Q-Tel, 2003, Central Intelligence Agency, 1 Aug. 2005 <http://www.in-q-tel.org>.

134 "In-Q-Tel: The CIA's Silicon Valley Bridge." Red Herring 8 Aug. 2005. 22 Aug. 2005 <http://www.redherring.com>.

135 United States, US Army Communications-Electronics Command (USACECOM), Department of the Army, Army Venture Capital Initiative Broad Area Announcement DAAB07-02-R-B223, 2002.

resources throughout the development cycle."[136] The Army clarified the objectives of the Army Venture Capital Initiative (AVCI) in the Broad Area Announcement (BAA). "The objective of the VCC [Venture Capital Corporation] is to improve the business relationships between the entrepreneurial community of high technology innovators and the United States Army."[137]

1. Army's Goals and Focus

Through establishment of a VCC, the Army hoped to take advantage of the network of small companies involved in innovative technology development. The benefits of doing so were twofold. First, the Army believed having a credible corporation that was dedicated to representing the Army's interests in the VC community would enhance awareness of innovative technology that exists or would exist in the commercial market. Second, the Army anticipated that by having this knowledge and access to new technology the transfer of developed products would be accelerated.

The Army chose to have the focus of their VCC be on engaging with companies that would improve the effectiveness of the individual combat-soldier, specifically the energy source that would power all the high-tech gear that is available to the soldiers. With all the technology being developed to improve the war-fighter's battlefield effectiveness in the areas of information management, state-of-the-art communications, battlefield visibility and awareness, mobility and comfort, and advanced weaponry, soldiers require an energy source robust enough to power a wide-range of equipment. The Army was looking (is looking) for an independent power/energy source that will allow the individual foot-soldier to operate for a period of days or weeks in extreme environments and over varying distances and terrain. The current technology available was deemed inadequate to meet the demands of the future soldier.

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[136]Bruce Held, and Ike Chang, "Using Venture Capital to Improve Army Research and Development," Rand Corporation (2000), 1 Sep. 2005 <http://www.rand.org>.

[137] United States, US Army Communications-Electronics Command (USACECOM), Department of the Army, Army Venture Capital Initiative Broad Area Announcement DAAB07-02-R-B223, 2002.

2. AVCI Broad Agency Announcement

In the fall of 2002, The Army Communications-Electronics Command (CECOM) released BAA: DAAB07-02-R-B223 to solicit proposals from companies interested in starting this type of venture. The chosen company would have to be formed as a not-for-profit corporation in accordance with Title 26, United States Code, Section 501(c)(3). The original length of the venture was to cover Fiscal Years 2002 and 2003. The $25 million award was to cover all aspects of the VCC to include all administrative, management, and legal fees; all business expenses; and all equity investments. In addition, the initial allocation would cover the cost of technology transition assistance to companies receiving VCC funding that are making efforts to transition technology to the Army.[138]

One special requirement in the BAA was that the VCC would be required to earn a significant enough Return on Investment (ROI) that the corporation could eventually be self-sustaining. This would require the organization to balance the primary objectives of transitioning technology into the Army and development of relationships with entrepreneurial community with the ability to earn a ROI that would allow future investments and cover all management fees. It would require the VCC to invest in technologies that would have both Army and commercial applicability, thus allowing the Army to leverage the commercial sector. CECOM received 20 proposals in response to the BAA. Of those proposals, Military Commercial Technologies, Inc (MilCom) was awarded the contract.

3. History of MilCom

In May of 2003, MilCom Technologies was awarded a contract to develop and manage the Army's VCC. MilCom is a venture-backed company that was established in 1997. Its business focus is creating and developing innovative technology companies

[138] United States, US Army Communications-Electronics Command (USACECOM), Department of the Army, Army Venture Capital Initiative Broad Area Announcement DAAB07-02-R-B223, 2002.

from technology developed from partnering defense contractors, commercial companies, federal laboratories and other leading-edge research and development sources.[139]

MilCom established the idea of commercialization of military technologies based on three factors. First, the federal government has a desire to develop leading-edge technologies to ensure national security and defense. This requires large research and development budgets. Second, as the military continues to downsize and budgets continue to shrink, the government has focused on achieving more value for the dollar, especially in the DoD. Finally, the commercial sector is constantly looking for new technology solutions related to communications and information technology.

4. Current Status of MilCom

MilCom has established itself as a market leader in the commercialization of military technologies. The corporation has been successful at leveraging technology developed through DoD RDT&E investment. MilCom has created and invested in thirteen companies since its establishment, attracting approximately $600 million in capital from its partners.[140] The corporation is also credited with creating approximately 800 jobs. MilCom has been successful at attracting other investors to its ventures. According to the MilCom AVCI proposal, it averages a 20 to 1 leverage on capital of its existing fund. MilCom has established partnerships with several leading venture corporations including BancBoston Capital, APAX Partners, Inc, Banco Espirito Santo, MDS Capital Corp., Motorola Ventures, and Nortel Networks.

5. MilCom's Business Plan

MilCom's business model includes building and supporting its affiliate companies at every stage of development. Like other VC initiatives, it uses a system that attempts to mitigate as many risks normally associated with new initiatives as possible. First,

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[139] "Various Pages on Website," MilCom Technologies, 15 Sep. 2005 <http://www.MilComTech.com>.

[140] Ibid.

MilCom's commercial advisors help to ascertain new and emerging markets in the commercial sector. The advisors are searching for "killer applications."[141] These applications will allow a new affiliate to quickly capture a significant share of the emerging market. To help identify killer applications, MilCom holds quarterly meetings with commercial companies, government representatives, and business leaders including venture capitalists and investment bankers. Once the killer applications are identified, MilCom works with its partners to find promising technology affiliated with the military sector that may prove to be lucrative in these markets.

After the technology has been identified, MilCom develops a solid business plan that will attract the level of investment necessary to ensure a high chance of success in the new venture. The plan is developed by its staff with input from engineers, venture capitalists, and technology professionals. Once the plan is solidified, MilCom works with its affiliates to create and recruit a talented team of professionals to manage, develop, and staff the new company.

In addition to continuing to mentor its new management team, MilCom continues to support the growing company after its launch by allowing the affiliate to leverage off its network of professionals and services. MilCom's affiliate services include valuation and investment strategy development, marketing advice, engineering support, legal, financial, tax and accounting support, help with recruitment of the board of directors, administration, industry relationships, and most importantly access to investment capital.[142]

To increase the opportunity for success, MilCom's commercialization process is designed to facilitate expedited transition of developed products to meet market needs. This will help the new company to achieve significant market share as well as providing superior returns to its partners and shareholders. Like other VC corporations, MilCom hopes to eventually achieve some type of liquidity event once the affiliate has reached a mature stage. To date, MilCom has only had one company go to an initial public

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[141] Mike Buffa, MilCom Technologies, MilCom Technologies' Proposal in response to AVCI Soliciation BAA: DAAB07-02-R-B223, 2002.

[142] "Various Pages on Website," MilCom Technologies, 15 Sep. 2005 <http://www.MilComTech.com>.

offering. In 2000, Triton Network Systems Inc, the first company launched by Milcom, went public. By August of 2001, Triton was liquidating and closing down.[143]

6. Affiliate Companies

MilCom's other affiliate companies include the following:[144]

- GlobalSys Service, Inc. (GSS): provides professional programming services to European and US companies.
- Real Digital Media (RDM): Markets and produces multimedia products for digital signage primarily used in point of sale advertising.
- SkyCross: Designs, Develops, and manufactures next generation antenna technology for mobile and fixed communication in the telecommunications, automotive and mobile computing markets.
- TelASIC Communications: a fables semiconductor company that will deliver high performance, cost-effective RF and analog mixed signal solutions for advanced wireless applications.
- The NanoSteel Company, LLC (TNC): a materials company that markets new unique steel coatings and parts for the metal industry.
- Theseus Logic: a fables semiconductor company developoing and marketing a family of "clock-less" digital signal processors.

In addition to these affiliates, MilCom established OnPoint Technologies as the Army's private not-for-profit corporation in accordance with their accepted proposal.

7. OnPoint's History

OnPoint Technologies was created by MilCom to serve as the bridge between the innovative technology community and the Army. Although MilCom is no stranger to working closely with corporations affiliated with DoD, OnPoint marks the first time it

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[143] Chad E. Watt, "MilCom: Still Standing, Still Making Tech Deals," Orlando Business Journal (2003), Lexis Nexis, Dudley Knox, Naval Postgraduate School, 15 Sep. 2005.

[144] "Various Pages on Website," MilCom Technologies, 15 Sep. 2005 <http://www.MilComTech.com>.

has worked directly with one of the DoD components. MilCom established OnPoint because MilCom is a for-profit corporation and the law requires a not-for-profit organization manage the Army program. Even though the two businesses are technically separate entities, they do share some members of the management team. Mike Buffa serves as the CEO and chairman of the board for MilCom as well as serving as chairman of the board of trustees of OnPoint. Jason Rottenberg is president of MilCom while serving as Managing Director for OnPoint in addition to serving as a member as its board of trustees. OnPoint, like other affiliate companies of MilCom, leverage MilCom's services. As Matthew Sheehan of Private Equity Week noted, OnPoint seems to be simply a fund managed by MilCom with the Army being its only limited partner.[145]

OnPoint opened for business in 2003 with the $25 million of capital invested by the original Army appropriation. In the 2003 Department of Defense Appropriations Act (Public Law 108-248 Section 8105), the Army Venture Capital Fund received a significant change. Not only did Congress approve an extension of the program (originally the program was to expire at the end of FY03), but the legislature approved the Army transferring up to $20 million of unobligated balances in its Research, Development, Test, and Evaluation appropriation account during the last fiscal year before the account closed.[146] The Army can only transfer this money to the account that will feed OnPoint. This provided OnPoint with a significant influx of capital. Jason Rottenberg, Managing Director of OnPoint said the two transfers the corporation had received as of June 2005 averaged $11 million.[147] In late July of 2005, OnPoint received another transfer from the Army, this one amounting to $14 million.[148] To date, OnPoint has received over $50 million.

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[145] Matthew Sheahan, "MilCom Marches to Army's VC Orders," Private Equity Week 16 June 2003, ProQuest, Dudly Knox, Naval Post Graduate School, 15 Sep. 2005.

[146] United States, Cong. House, Department of Defense Appropriations Bill, 2003, 107th Cong., 2nd sess., 532, 25 June 2003, 9 Oct. 2005 <http://thomos.loc.gov>.

[147] Jason Rottenberg, personal interview, Jun 2005. Comparative analysis of figure was calculated through data on Thomson VentureXpert database and arrived at similar number.

[148] "Army's Venture Capital Effort Gets $14 Million Reprogramming Boost," Inside the Army 8 Aug. 2005, 15 Sep. 2005 <http://insidedefense.com>.

Currently, OnPoint has about one-fourth of its fund invested in its affiliate companies with another quarter obligated for future rounds of investment. The other half will be used to fund future investments as the opportunities present themselves. OnPoint forecasted making between four and six investments each year with the average investment ranging from $500,000 to $2.5 million. In operation for two years, OnPoint is currently at the lower side of this estimate with 8 affiliate companies. However, Rottenberg said, "some quarters we won't make any investments and others we may make several investments."[149] The focus is on the quality of the investment and leveraging its VC partners to develop a company that has a strong chance of transitioning technology.

8. Investment Focus

As stated in the BAA, OnPoint is focused on investing in companies (or starting companies) that offer significant technology in the field of personal power and energy sources. Its interests include generation, including fuel cells and micro-turbines, storage including batteries and capacitors, management using semiconductors and software, controls with circuits and voltage sensors, distribution using conducting polymers and super conductors, and usage with low power logic and components.[150] OnPoint looks for individuals, teams, and companies that can provide innovative technologies or solutions for the needs of the Army. These groups need to have insight into their markets along with a technology that has the opportunity to capture a significant portion of the market so that a sufficient return on investment can be realized.[151]

OnPoint must balance the needs of the Army and the need for a substantial return on investment to eventually sustain operations and investments. Rottenberg says the

[149] Jason Rottenberg, personal interview, Jun 2005.

[150] "About OnPoint," OnPoint Technologies, OnPoint, 15 Jul 2005 <http://www.onpoint.us>.

[151] "About OnPoint," OnPoint Technologies, OnPoint, 15 Jul 2005 <http://www.onpoint.us>.

operation mirrors “a corporate venture fund.”[152] It is structured like a typical VC, but takes a more strategic focus on identifying and transitioning technology.

The strategic focus allows OnPoint to invest at any stage of development. Many VC companies like to invest in the early stages of a venture. Early partnerships with affiliates tend to lead to higher return on investments. Rottenberg stresses, more important than the high ROI, is the importance of OnPoint finding companies that have a strong probability of success.

9. Compensation

OnPoint’s compensation structure resembles the industry average. Its management fees and performance fees are slightly lower than the industry standard. However, since the focus of the program is transitioning technology to the Army, a special feature is provided in the compensation package that allows OnPoint to capture a significant bonus when products are actually transferred to the Army from a company that OnPoint has invested in.

10. Risk Mitigation

Again, since the focus is providing technology transfer to the Army, OnPoint tends to be slightly more risk adverse than the typical venture capital company. Using the same basic business plan that MilCom established, OnPoint attempts to mitigate risk by using a series of valuation metrics. The valuation metrics include ensuring technology meets the needs of the Army and that market, technology, management, and financial risk are assessed and mitigated.[153]

First, venture opportunities that have greater probability of transferring needed or improved technology to the Army will receive higher valuation than companies that do

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[152] Matthew Sheahan, "MilCom Marches to Army's VC Orders," Private Equity Week 16 June 2003, ProQuest, Dudly Knox, Naval Postgraduate School, 15 Sep. 2005.

[153] Mike Buffa, MilCom Technologies, MilCom Technologies' Proposal in response to AVCI Soliciation BAA: DAAB07-02-R-B223, 2002.

not, even if those companies have a stronger probability of a higher ROI. Second, products that have "dual use" and the potential to capture significant market share in the form of competitive advantages will also receive high value marks. Third, OnPoint spends a significant amount of time researching the technologies that are being proposed. In doing so, technology is evaluated on the risk of development in the context of time to produce (time to market), cost (longer development higher cost), and potential value to customers.

Fourth, management risk is critically important to OnPoint. OnPoint, like MilCom, wants to ensure an invested company has the right tools to succeed. This means it will not invest in a company that does not have or the potential to have a strong, experienced management team. Finally, OnPoint attempts to mitigate financial risk by looking for ventures that have the potential to have positive cash flows within two to three years. Its staff looks to balance the risk with the amount of cash required by the investment. The lower cash requirement with the high prospects of near term positive cash flow would receive a higher valuation.

11. Portfolio[154]

The following are companies in which OnPoint is currently invested. None of the affiliate companies have achieved a liquidity event at time of publication.

- A123 Systems: developer of advanced Lithium-Ion based cells for rechargeable battery packs.
- Atraverda: developer of advanced bi-polar battery electrodes for rechargeable batteries that can be utilized in a wide ranged of chemistries, including lead acid, NiMH, and Li-Ion.
- Integrated Fuel Cell Technologies, Inc (IFCT): developer of next generation fuel cell systems in portable systems.
- Nanosolar: developer of thin-film solar technology for roll-to-roll printing of solar cells on flexible substrates.

154 "About OnPoint," OnPoint Technologies, OnPoint, 15 Jul 2005 <http://www.onpoint.us>.

- PowerGenix: developer and seller of next-generation rechargeable batteries.
- PowerPercise Solutions Inc.: fabless semiconductor company specializing in battery management devices.
- Ultracell: developer and seller of integrated fuel cell systems.
- Zinc Matrix Power: developer of high-performance rechargeable alkaline battery technology for commercial and military markets.

12. OnPoint Successes

Although OnPoint has been able to identify several promising technologies that have the potential for Army use, to date there has only been one transfer of a product to the Army. In December of 2004, Gary Davison, CEO of PowerPercise Solutions presented the Assistant Secretary of the Army for Acquisition, Logistics, and Technology the BA-5590A battery pack with an integrated low-cost state-of-the-art power indicator. The BA-5590A is the most widely used battery in the Army. It powers the SINCGARS radio and several other small electronic devices. A typical field evolution would find soldiers throwing away batteries with several hours of battery life left because there was no simple way of knowing how much power remained. This innovation is expected to save the Army (and Marine Corps) millions in procurement, disposal, and storage costs each year, not to mention the reduced logistical burden on the soldiers. The entire project from development to production took ten months and the Army and OnPoint look to this as an example of how the venture community can help to provide and transfer technology to the Army.

13. Outlook

OnPoint's outlook for the future with the Army seems to be positive. The fiscal year 2006 Department of Defense Appropriations Act is expected to include language that extends the program's funding through FY08. At the current rate of capital investment by the Army, this would bring the fund to nearly $75 million in FY08. Rottenberg says that the power and energy industry has some promising technologies that

are near full development. He expects higher-energy batteries that will allow soldiers to carry 2 batteries instead of four at a reduced weight and longer battery life. He also expects the introduction of fuel cells that will allow soldiers to rely on small cartridges instead of bulky batteries.

Although it is still relatively early in the company's history, Rottenberg is interested in expanding the corporation to include other Army interests as well as other components and DoD organizations.

IV. OPTIONS FOR DON INVOLVEMENT IN VENTURE CAPITAL

This chapter will discuss possible options the Navy can undertake if it wishes to enter the VC industry. There are literally hundreds of models being used today by VC firms, as well as corporations, and all levels of government. Some of these models have been successful, many more have not. When reading this chapter, the reader should take note that the options being put forth are not all inclusive. Looking for options for a venture initiative is a complex process. In order to simplify the process for the reader, this chapter will be broken down into the following subsections:

- DoN Technology Needs
- VC in Relation to the Navy's Technology Model
- Alternatives for Navy Involvement in VC
    - Status Quo
    - Engage VCs Through a Liaison Office without Equity Investments
    - Invest in Current Government VC initiatives
    - Establish a Navy Specific VC Firm

Previous chapters of this paper have discussed several types of venture activities which represent government interests. Based on these previous sections and the framework listed above, this chapter will now allow us to further analyze specific models with respect to the Navy's goals. While there are many valid business models for VC activity, we limited this section to the four options listed above because our research indicates that these models represent the broadest scope of involvement with the greatest probability of success. It is important for the reader to understand that each option that will be discussed is valid for a specific set of objectives. As such, the criteria for success in each model will be different. In the next chapter, we will put forth our recommendation as to which model will best suit the Navy's needs.

A. DON TECHNOLOGY NEEDS[155]

There are several areas of technology in which the Department of the Navy is interested. The Navy's Office of Naval Research (ONR) has the responsibility of communicating the Navy's technology needs to those organizations that may provide solutions. These organizations include government and private labs, schools and universities, and for-profit and not-for-profit businesses. Navy needs are communicated to these organizations through a variety of channels including Broad Area Announcements, solicitations, Federal Business Opportunities (FedBizOps), X-tech websites[156], conferences, and technology roundtables. The range of technology needs spans the vast capabilities and missions of the Navy and Marine Corps.

ONR is organized into five science and technology departments that focus on specific areas of research and development.[157] The first department is the Information, Electronics, and Surveillance Department. Its focus is on technology programs that attempt to enhance surveillance capabilities, communications, command and control, human-computer interaction, and electronic warfare. Second is the Oceanic, Atmospheric, and Space Department that focuses on sensing and systems and processes and prediction of integrated, multidisciplinary programs in naval environments and undersea warfare. Subjects covered in this department include battle space environments to anti-submarine warfare to mine warfare. Third, the Engineering, Materials, and Physical Sciences Department helps contribute to naval strengths in the areas of chemistry, physics, structural and functional materials, structural, solid, and mechanics, as well as propulsion, energetics, and hull, mechanical, and systems. The fourth department is the Human Systems Department. Human Systems are concerned with

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[155] "Various Webpages," Office of Naval Research, Department of the Navy, 1 Oct. 2005 <http://www.onr.navy.mil>.

[156] X-tech are organizations that are designed to identify technologies desired and either find a commercial solution or have a solution developed. The X-techs include AirTech (Aircraft), SurfTech (Ships), CarTech (Carriers), SubTech (Submarines), and I-Tech (ForceNet). In addition, the Marine Corps Warfighting Lab (MCWL) provide Marine Corps specific needs.

[157] There are literally hundreds of specific needs listed on several websites, announcements, and solicitations. Our goal here is to attempt to demonstrate the wide variety of capability needs the Navy has by showing how ONR classifies its research and development.

programs that are at the leading edges of medical science, human performance, biotechnology, training and human factors, neural information processing, and biorobotics. Finally, the Expeditionary Warfare Division is concerned with aeronautics, avionics, propulsion, ballistics, warheads, missile guidance, seekers, parallel distributed processing, stealth technology, advanced sensors, and other programs associated with Marine Corps and other ground combat operations.

Although several of the areas of research and development that the Navy is interested in pertain to specific Navy capability needs, many areas may have, at least limited applicability to other federal, state, and local governments, as well as the commercial sector. Finding ways to leverage these other agencies to make the R&D dollar stretch a little further makes sense. ONR has achieved some success in this endeavor through its industrial and corporate programs like ManTech (Manufacturing and Technology Programs), technology transfer programs, corporate internships, SBIR/STTR, and most recently, the establishment of the CTTO.

According to the CTTO's web page there are several specific focus areas in which it is currently interested.[158] First, the CTTO is looking at technologies that address the ever changing needs of the Global War on Terrorism (GWOT). These could include data fusion and information processing, distributed operations, and the prediction, detection, prevention, and neutralization of Improvised Explosive Devices (IED). Second, the office is focused on finding ways to improve the linkage between the Navy's Sea Shield, Sea Strike and Sea Basing initiatives (called FORCEnet). This includes improvements in shared situational awareness across the force, technologies in computer network defense and information assurance, ubiquitous communications and network infrastructure including bandwidth management, data link management and architecture, and Joint combat ID (blue force tracking). Next, the Navy has a need for technological advancement in power generation, distribution, and management, as well as advancements in sensing technology for data processing, monitoring, and targeting. The Navy is also interested in advancements in autonomous vehicles and other robotics.

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158 "Naval Needs," Commercial Technology Transfer Office, Office of Naval Research, Department of the Navy, 1 Oct. 2005 <http://www.onr.navy.mil>.

Finally, CTTO is concerned with innovative ways to improve logistics by way of asset visibility, materials handling, and obsolescence. Although these specific focus areas were listed, the CTTO is always looking for any new technology or innovations that could prove to be a cost saver or improve an existing capability.

The areas of focus listed by the CTTO have the potential to be addressed though the commercial sector. There are several private corporations and organization, as well as many government organizations that are faced with the same problems and needs as the Navy. Leveraging these organizations to discover answers to these issues provide benefits to all involved. The Navy is already addressing these problems through its industry and corporate programs. The question concerning this research is can the VC community assist the Navy is providing alternatives to its needs?

B. VC IN RELATION TO THE NAVY'S TECHNOLOGY MODEL

There is no question that budgets in the Navy and other government agencies are getting tighter. The Navy is constantly looking for innovative ways to improve efficiency and effectiveness. The area of Research and Development is no different. The Cold War Era of defense-leading innovation is over. Because of this, DoD is now a smaller customer and must look for ways to leverage others in order to meet its capability needs. This will require increased focus on commercial or dual-use technologies. "The Department will develop military-unique capabilities only after it has determined that commercial capabilities will not meet its requirements."[159] VC may prove to be a viable asset for recognizing and meeting these requirements.

The question of whether the VC market is a viable investment opportunity is debatable. During the "dot com" boom of the late 90's and early 00's, the returns on equity investment from VC firms steadily outpaced more traditional investments. In 1999 and 2000, venture capitalists were seeing 5-year rolling average returns of 47%

[159] William J. Perrry, United States, Department of Defense, Annual Report to the President and Congress, Washington, DC, 1995.

compared to the mid 20's and low 30's for the S&P 500 and NASDAQ respectively.[160] However, like other investments falling victim to the market forces in recent years, VC returns have been less than stellar and 5-year averages have fallen to -1.3%. This average is still higher than the S&P's -5.4% and the NASDAQ's -11.8.[161] Since the Navy's primary reason for being involved in VC is not return driven, this should not be a real concern. The question then becomes, can the VC market provide the technological advances or knowledge that the Navy needs?

First, the VC community is already investing in the technology areas stated as focus areas by the CTTO. In 2004, venture capitalists invested $6.4 billion in 901 companies in the computer hardware and software industries; $3.3 billion in 325 companies in the communications industries; $2.2 billion in 230 companies in the semiconductors and electronics industries; and $684 million in 110 companies in the industrial and energy industries.[162] There is plenty of opportunity for the Navy to leverage the money being invested in the commercial sector.

Second, venture backed companies have been proven to be effective contributors to the U.S. Research and Development industry. Venture capitalists are willing and able, through their financial instruments, to invest in high-risk innovative projects. This is confirmed by the evidence that technological revolutions which have resulted in the transformation of industries have been led by VC-backed firms, for example, the firms that have pioneered each new generation of computer technology (PCs, personal computers, software, etc.) have been financed by VC[163].

As stated previously in Chapter II, some research has been conducted on the innovation contributions of venture backed companies. Dr. Josh Lerner and Dr. Samuel Kortum found that between 1983 and 1992, while VC funding averaged less than 3% of corporate R&D, it was responsible for approximate 8% of industrial innovations during

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[160] National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

[161] Ibid

[162] Ibid

[163] France, Organization for Economic Development and Co-operation, Venture Capital and Innovation, Paris, 1996.

the same period[164]. Their study went on to find that a dollar of VC funding was about three times more potent for stimulating patents than a dollar of traditional R&D.[165]

In another study by the National Venture Capital Association, it was determined that for the last 20 years, small businesses, the type in which venture capitalists have interest, have been contributing more to U.S. Research and Development. In 2003, small companies contributed $40 Billion in R&D, up from $4 Billion in 1984. This accounted for an estimated 20% of the total U.S. R&D in 2003 compared with just over 5% in 1984.[166]

If Lerner and Kortum's theory holds true, the influx of funding has caused an increase of innovation provided by VC backed companies. With the increased contribution of VC backed companies to the R&D industry; it makes sense for the Navy to leverage this sector with its own technology needs.

Third, being involved with VC can provide access to companies that would not otherwise do business with government agencies. There exists a perception by some small businesses, whether warranted or not, that doing business with the government is bad business. A survey of technology firms in 2003 showed that 40% of the IT companies interviewed did not want to do business with DoD.[167] Whether it's the regulations and restrictions that come with taking the government's money or the slow payments that can sink cash strapped young companies or the fear of "red tape" or even losing intellectual property rights, a sector of the innovation market would rather take its money from private investors. Partnering with the VC community may provide access to these companies. If the Navy were to approach a company through a VC firm as a potential investor, it may break down some of these barriers.

Fourth, venture capitalists may provide access to technology that the Navy did not know existed. As stated in Chapter I, the VC community is based on networking.

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164 Samuel Kortum, and Josh Lerner, "Assessing the contribution of Venture Capital to Innovation," Rand Journal of Economics (2000), 28 Oct. 2005 <http://www.rje.org>.

165 Ibid

166 Venture Impact 2004, Arlington, VA: Global Insight, 2005, Venture Capital Benefits to the U.S. Economy, 28 Jul 2005 <http://www.nvca.org>.

167 "Survey of Information Technology Firms," National Defense University, Oct. 2003, Department of Defense, 30 Oct. 2005 <http://www.ndu.edu>.

Through this network VCs have access to established businesses and corporations, start-ups, labs, universities, and people with just a good idea working out of their garage. To be involved in this type of network requires a special skill set and access to a broad stream of investment prospects. Fund managers are experts in their areas and typically look at hundreds of deals before making an investment. They have management backgrounds and established networks in specific industries. Their skill set includes, financial acumen, expertise in dealing with people, and negotiating knowledge.[168] But it is not only these skills that are required; the VC is an apprenticeship business. It takes years of mentoring to be able to assess investments, build and motivate management teams, source capital and strategic partners and deal with the unpredictable threats to the business.[169] Establishing relationships or being involved in the VC community gives visibility to the technology that these small companies have, but that can only be accessed through the VC network.

Finally, by becoming a corporate venture capitalist, the Navy can benefit from increased awareness of technology innovations. Corporate VC is a specific type of venture investment that is conducted primarily by non-financial corporations. The focus in corporate venturing is not so much return on investment as finding investment opportunities that are congruent with the parent company's strategic technology or that provide synergy or cost savings.[170]

Dr. Gary Dushnitsky of the Wharton School of Business at the University of Pennsylvania says that large corporations are realizing that they no longer have a monopoly on the next big technology breakthrough. "They [corporations] need a tool to scan, identify, and leverage or harness entrepreneurial or innovative technologies."[171] As stated previously, the DoD and the Navy have realized that it is not feasible for government labs and R&D facilities to produce all of the needed capabilities. Like their

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168 "What Makes a Good Venture Capitalist?" Flag Capital, 1 Oct. 2005 <http://flagcapital.com>.

169 Ibid.

170 National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

171 "How Corporate Venture Capital Investing Increases Innovation," The Wharton School, University of Pennsylvania, 15 Oct. 2005 <http://knowledge.wharton.upenn.edu>.

corporate counterparts, these organizations must look externally. With the innovation and contributions of VC backed companies, the venture market may provide the needed visibility.

Dushnitsky goes on to explain that corporate venture capital is one leg of a three-legged stool whose other two legs are a strong internal R&D capability and strong alliances with academic or government researchers.[172] This analogy fits nicely with the Navy's research and development strategy. The Navy already has well established internal R&D in addition to programs that focus on academic research. Dushnitsky and Michael J. Lenox, partnered to conduct research that focused on comparing companies that invested in corporate venture capital with those that did not. They concluded that corporations which make venture investments to gain access to outside innovations tend also to have strong internal research and development capabilities and that the two are "complements rather than substitutes vying for research dollars."[173] In addition, their research has found that the contribution of corporate venture capital investment to firm value is strongest when it is focused on attaining a window on technology rather than purely a narrow return on investment.[174] This seems to be the Navy's focus also. The Navy already has some of the needed components to have an effective corporate venture capital program.

We have identified several benefits to the Navy being involved in VC. First, VC firms are already investing in the same areas in which the Navy is interested. Second, VC backed companies are proven innovators. Third, VC firms may provide access to companies that would not normally do business with the government. Fourth, VC firms may provide insight into technologies not previously known. And finally, the Navy already has many of the needed components to establish a corporate venture program.

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[172] "How Corporate Venture Capital Investing Increases Innovation," The Wharton School, University of Pennsylvania, 15 Oct. 2005 <http://knowledge.wharton.upenn.edu>.

[173] Gary Dushintsky, and Michael J. Lenox, "When do Firms Undertake R&D by Investing in New Ventures," Strategic Management Journal (2004), 15 Oct. 2005 <http://knowledge.wharton.upenn.edu>.

[174] Gary Dushintsky, "When do Corporate Venture Capitalist Investment Create Firm Value," Strategic Management Journal (2004), 15 Oct. 2005 <http://konwledge.wharton.upenn.edu>.

For these reasons, we believe that the DoN can benefit from establishing a venture initiative. The next subsection will discuss possible options for establishing a venture program.

C. ALTERNATIVES FOR NAVY INVOLVEMENT IN VC

1. Status Quo

The first option is to decide not to engage or be involved in the VC industry. The decision to not engage the VCs does not mean that the Navy cannot observe current VC programs. Although the government has a few venture programs that have been around for a significant amount of time, the majority of VC programs are relatively new and untested. By not engaging the VC community but instead, closely observing the VCs, the Navy may be able to get a better understanding of its goals with respect to VC and the possible returns that may be possible to enjoy.

In-Q-Tel has probably enjoyed the most success thus far in transitioning technology into its organization and would prove to be a good target for observation, as would OnPoint. Even though OnPoint has only had one "successful" transition, it is a much younger firm that has great potential. However, time will be the true test for both of these organizations though. Taking a "wait and see" position could reduce the risk of losing millions of dollars into a venture that fails to produce any fruit. There is no budget impact in the business as usual option; however there may be opportunity cost.

If it is true that VC can fill a gap in the Navy's view of innovative technology, by not participating in some type of VC activity, the Navy could be missing solutions to capability needs. In addition, if the Navy decides to become involved in VC at a later time, it may be forced to work in the constraints set by laws and regulations shaped by other agencies. For example, the Army required special appropriation language to get its program off the ground. If the Navy decides to go with a program significantly different than the Army's, it may be forced to work under that precedence.

Currently, several agencies are looking at a myriad of tailored programs. By waiting to be involved, the Navy may miss the opportunity to help define the government's role in the venture industry.

2. Engage VCs through a Liaison Office

This option is closely related to previous efforts by the CTTO to engage the VC community. It calls for the establishment of an office or expansion of an existing office to act as a liaison or intermediary between the VC industry and Navy's system commands and program managers. The office would work closely with both groups having an in-depth knowledge of the Navy's needs and an understanding of how the VC community may be able to meet those needs or, if needed, create solutions for the Navy.

Establishing an office or section within the Navy's corporate structure would allow the office to tap into the vast knowledge base of current needs and capabilities already established and documented in existing organizations such as ONR. Locating the office within this structure would allow it to have a broad scope and utilize existing lines of communication with system commands and program managers. It would facilitate knowledge sharing and coordination to hopefully reduce duplication of effort in researching and finding new technologies.

Another significant benefit to this option would be the control and visibility given to the Navy that would not be realized under other options. Since the office would fall under the direct control of the Navy leadership, senior officials would be able to direct the efforts of the staff in regards to certain technology families and critical needs. This would provide for a much more flexible program than would be received through a private firm bound by contractual covenants. This new office would be able to refocus efforts to meet emerging needs associated with the ever changing battlefield. In addition, due to the flexible nature of this operation, the scope of effort could possibly be adjusted to meet budgetary restrictions. This benefit would not be realized under a ridged contractual agreement that would be required for direct investments.

Since equity investments would not be required, the financial risk associated with an investment program of this sort is reduced. In addition, this option would help to mitigate the political risk associated with the government operating and investing in its own VC firm.

This option has some considerations and limitations that should be noted. First, since this program would still fall within the regulations and restrictions associated with other government programs, the Navy may still not be able to reach that small portion of the innovation market that is averse to working with the government. In addition, the liaison office would still be bound by appropriation and acquisition law in funding, researching, and developing new technologies.

Second, the Navy corporate leadership would need to overcome the cultural concerns on Temporary Additional Duty (TAD) travel. Throughout the Navy and Marine Corps there is a concern associated with individuals that travel a great deal. To be successful in the venture community, the liaison team would need to meet with VCs, attend technology conferences and conventions, and hold such meetings to demonstrate the needs and desires of the Navy. As stated previously, the VC community is based on networking. To be successful, the liaison office would need to be fully engaged with the community and that would require a significant amount of travel.

Third, whether a new office is established or the mission is given to a functioning office, the endeavor would require an influx of funding to get started. The new venture would require an increase in staffing. The new staff would need a special skill set that would allow them to understand and communicate the technical needs of the Navy while at the same time be able to comprehend the business needs of the VCs.

The fourth and final limitation that will be addressed with this option is the differentiation between the customer and investor relationship. If the Navy were to engage with VC though a liaison office without equity investments, then it would become just another possible customer to the VC firms. While this is not necessarily a bad thing for the Navy, it may prohibit them from being privy to insider information about the technology or the industry in which the VC firm is operating. If the Navy wants to

transition technology, this would not be a factor. If the Navy wants to learn about the technology coming from a specific industry, this option could limit the information available to it.

3. Invest in a Current VC Initiative

Investing in an established fund would give similar advantages and disadvantages to the Navy when compared to establishing its own private VC company. One significant difference is investing in a current fund would require less capital outlay at start up because the investment would be based on an established fund and business plan. This still would allow the Navy to leverage other corporate, private sector, government, DoD and service investments. This option would also allow the Navy to research and invest in a fund that meets specific Navy needs or allow it to seek joint ventures with other DoD components. Further, this option would help facilitate technology sharing across the DoD by encouraging components to leverage one another to obtain the greatest value for their dollar.

While this option has definite advantages that are provided though equity investments, there are some challenges that this option presents as well. First, even if the Navy were able to find other components to invest in a specific technology, the Navy may be competing with other investors in researching specific technology to meet the Navy's needs. This means that the Navy might have to align its needs with the fund's current investors.

The second challenge is that this option will cost money. If the Navy were to decide to do this, it would need to commit enough capital to justify equity investments for the investing firm. The amount of capital required could be in excess of $10 million dollars, depending on the number of investments planned and the focus area of the investments. The Navy may also be required to make capital infusions for a number of years in order to see the investments through to maturity. This option would be a long term program.

The final challenge, related to the first, is that an established fund already has an established management system and business plan. It has a set direction in the type of

industry in which it is investing. A new investor into the fund may find it difficult to modify or change that direction. In addition, if this fund is defense focused (finding technologies for DoD components), the Navy would be competing with the needs and interests of other DoD agencies and components. To gain full value of leveraging from other agencies, the Navy would need to consider the motives and desires of other investors. If the Navy were to choose to establish its own direction within a specific fund, this would most likely result in an increased management fee assessed to the Navy and require the Navy to put up significantly more money than it otherwise would have in order to justify the increased investments.

4. Establish a Private VC Firm

Although there is precedence already functioning in government, establishing a private VC firm is probably the most complex, costly, and risky option of all those proposed. However, as with any investment, the increased risk gives the opportunity for increased returns.

There are several benefits to starting a private venture activity. First, the company would be able to function independently of government restrictions and bureaucracy that bog down current technology acquisition programs.[175] The formation of the company would allow the Navy to leverage other private investors allowing the cost of research, development, and some testing and evaluation to be shared by investors who would benefit from the commercial applications of the products developed. This also would allow for economies of scale in production. If theory were to hold true, the Navy would not be the target market for the technology being developed. This means that it could take advantage of increased production and reduced procurement costs. In addition, even if the Navy's company were just a minority investor in a particular start-up company, this could still give it the same access to information on the technology and market to which an investor is privy.

175 Andrea Shalel-Esa, "Pentagon must fix weapons buying, says panel exec." MSNBC.com 19 Oct. 2005. 20 Oct. 2005 <http://www.msnbc.msn.com/id/9756097/>.

Equity investments can also buy a seat at the board of directors' table. This would allow the Navy to have some influence in the direction of the company and thus the technology being developed. This could also provide for significant cost savings from identifying the Navy's required modifications to a particular product in the development phase vice production or post-production. Further, having access to the technology as a partner would give the Navy the opportunity to test and evaluate technology in its own labs prior to the product reaching the commercial shelves. This could decrease the overall acquisition time of getting the technology in the war-fighters' hands.

Being involved in the venture market could also prove to be useful in engaging companies that may not typically do business with the government. Many small companies are hesitant to do business with the government. They may be weary of the bureaucracy that goes along with dealing not only with DoD, but prime contractors associated with the defense industry. In addition, many small companies do not know or understand how to gain entry into doing business with the government. Establishing a private company could provide the creditability and "cover" that is needed to gain entry into that portion of the innovation technology sector that is cautious in doing business with the government. The private company could also give the new company credibility with other investors showing that the agency has some "skin in the game" and is serious about making a return on its investment.

Finally, operating a private firm would give the Navy the opportunity to establish a self-sustaining program. If the company is operated correctly, it would show a profit. Companies that are invested in will eventually be taken public, sold, or merged with other companies. This would also generate revenue. Compensation plans can be designed to increase the likelihood of return on investment as is done with OnPoint or In-Q-Tel. After a number of years, there should be enough capital in the fund to sustain operations at a certain level.

Clearly there are some advantages in the Navy's starting a private VC company. However, there are also disadvantages and obstacles that will have to be overcome. First, to be effective in the VC industry, the Navy must clearly define its goals for the new

company. The majority of VCs specialize in only one industry (e.g. communications, IT, fuel cells, biomedical…). Even if the Navy is able to spend $20 million per year in VC, that may still not be enough to properly establish a fund[176]. With best case scenario spending of $20 million per year, DoN leadership would have to pick one segment of industry on which to focus its VC initiative on. This would require all interested parties to agree on a particular technology that would benefit a majority of program officers. With so many needs existing in the Navy today, this would be a challenge in itself.

Second, establishing a private company carries all the risks that are carried by any private corporation. There are no guarantees that any of the technologies identified will ever make it out of the development stage, let alone into the hands of the war-fighters.

Another concern is once the company is formed, the Navy will have very little control over the actual investments being made. The private corporation would require the flexibility to make investment decisions that it feels will provide the best return to the Navy. This return may be in the form of ROI or technology. Transitioning technology or acquiring knowledge of technology cannot be the only goal of a private company. The Navy will need to develop a compensation package that allows for the firm to generate revenues. This requirement is twofold. First, for a new VC firm to be taken seriously and gain access to the "right" information; it will have to be driven toward profit. VC firms are in the business to make money. If a company's only goal is to gain access to information, the likelihood of it being invited to participate in order to leverage other VC firm investments greatly decreases. Secondly, if the company is to eventually become self-sufficient, it must be able to generate revenue. With this revenue generation requirement, the Navy's goals and the goals of the firm (or VC community in general) may conflict at times.

Fourth, to gain creditability with other VCs, the Navy must be willing to fund the program at a level that will allow it to enter the market and compete with other investors. Although VCs rarely invest the entire fund at one time, capital also needs to readily

176 Karthic Jayaraman, Personal Interview, June 18, 2005; Howard Strateman, Personal Interview, June 18, 2005; and Jason Rottenberg, Personal Interview, Jun 2005.

available for later round investments in funded companies, opportunity investments, and emergencies. The Navy need to ensure that adequate funding is available to cover both of these aspects.

Finally, with any private investment of taxpayer funds, there are political concerns that will need to be addressed. Whether directly invested or through a not-for-profit private organization, the investments made can be directly attributed to the Navy. If something were to go wrong with a project, the Navy must be prepared to be associated with the problem.

V. RECOMMENDED ALTERNATIVE FOR NAVY VENTURE CAPITAL PROGRAM

This section of the paper will address our recommendation as to what type of VC program the Navy should undertake if it wishes to enter the VC industry. Much of the information that is put forth in this section is based on original ideas developed after researching the industry and interviewing numerous VC entrepreneurs, both inside and outside the government. Because many of the ideas in this section are our own intellectual property, there will not be as many cited sources as previous sections of the paper. Specific to this section, we will address the following:

- Recommended Navy Approach
- Reasoning Behind the Recommended Approach
- How to Structure the Navy Venture Capital Office
- Challenges in Setting up the Navy Venture Capital Office
- Expected Benefits of the Navy Venture Capital Office
- Recommendations on How to Market the Navy Venture Capital Office

When writing this chapter, we tried to keep the recommendations in line with the draft Navy VC legislation currently before Congress[177]. Similar to the Army legislation approved by Congress, the Navy legislation would approve a certain amount of unobligated R&D funds to be transferred into a Navy VC fund. This funding could then be put to use in a "Navy VC Engagement Demonstration". While this chapter is based on that legislation, the focus will be on how the Navy can implement the legislation to gain the greatest benefit.

[177] Appendix A

A. OVERVIEW OF RECOMMENDED APPROACH

As the previous chapters of this paper stated, research indicates that there is an untapped market of new ideas coming out of the VC industry of which the Navy is not taking full advantage. The proposed Navy legislation is significant because it recognizes the technology coming from the VC sector and its potential impact to the Navy. The legislation is also significant because it provides the Navy a means to access the technology, specifically, through CRADAs. We feel that the legislation, while an important step towards accessing the VC technology, does not address the additional non-financial assets that are required to tap the VC industry, most specifically, human capital.

As a result of this oversight, the recommendations that will be presented center on the Navy creating an infrastructure which would allow it the best possible means of using the unobligated balances for which the legislation would provide. The main focus of this infrastructure is for the Navy to reestablish a VC liaison service that was previously operated under the CTTO office and includes an optional provision to invest funds in other government VC initiatives (see Figure 12).

Figure 12. Technology Identification

B. REASONING BEHIND RECOMMENDED APPROACH

The reasoning behind the recommended approach is straight forward. While the proposed legislation clearly provides the financial resources to make VC investments, there are still many unanswered questions regarding the Navy's VC program. Specifically, our research left the following questions unanswered:

- What are the Navy's goals with VC? Transitioning new technology or identifying technology?
- Who will decide on the technology focus?
- Who will be evaluating the technology for the Navy?
- What office will be responsible for controlling the funds?
- Where can the VCs go to communicate with the Navy?
- How will the Navy identify the VC firms in a given industry?
- If promising technology is identified, who will help transition it to the Navy?

While the proposed legislation starts to identify some of these issues, most notably by identifying the CTTO office as the office that will transition the technology, most of the questions remain unanswered. As a result, the Navy must establish some coordination center for the Navy VC "engagement demonstration" if it is to be successful.

The first question listed is one of the most important because it establishes the direction of the Navy's Venture Capital Engagement Demonstration. The central question is "What is the Navy's main goal?" Is the objective to simply identify new technology coming out of the commercial sector in a cost effective manner, or is the Navy's goal to transition this technology into the fleet? Can the Navy do both?

Once the question on the Navy's goals has been answered, the next question centers on who will decide on the Navy's VC focus. The VC community is segmented by industries. The Navy will need an organization that understands this segmentation,

has contacts in the different sectors and can coordinate the Navy's goals across the different sectors. Research indicates that there is currently no single office that has the resources and industry knowledge to do this.

Once the Navy has a VC goal and has identified what areas of the VC industry it wants to focus on, it will next need an evaluation team that is able to look at the technology and decide if the technology can benefit the Navy. This team of engineers will need to understand the Navy's mission and needs. The members will need to act as the liaisons that seek out VC firms with promise of delivering the technology and then decide if the technology can benefit the Navy.

The fourth question revolves around who will control the funds? If the Navy becomes an investor in the VC industry, then it is imperative to have one central office that will be in charge of the funds and distribute them based on the Navy's needs. These needs will come from the engineers identified in the previous paragraph based on input from SYSCOMs.

The fifth question is more closely aligned with the needs of the VC community. The VC industry is very communications orientated and will need to know how to contact the Navy. The issue is more than just informal contact. The VCs will need an interaction office with the Navy that will allow for direct two way communication. This will be an office where the Navy can go to initiate contact with the VC community as well as an office where the VCs can go to market themselves to the Navy.

The sixth question is also a follow-on to the previous question in that it deals with the communication issue. As previously stated, the VC industry is segmented by the type of industry invested in. VC firms further segment themselves into industry subspecialties. This means that the Navy will need to know who to talk to in a given industry to address its needs. The Navy will need an office that knows the lay of the land in the VC world.

The final question that will need to be addressed is in regards to the final product the Navy is expecting from its VC initiative, be it transitioning VC ideas and / or technology to the fleet. Research indicates that it is imperative to have an office that can do this. This question is listed last because this is an all encompassing question. This

final step is the end result of the Navy VC initiative and if this step cannot be properly executed, then the Navy should question the validity of a VC approach.[178]

All of these questions point to the reasoning on why there needs to be a VC oversight office. Increased funding by itself is not sufficient to establish a successful VC program. The funding the Navy provides for the VC program will only be effective if there exists an infrastructure that can properly use the money and execute the program. While the appropriation language speaks to the CTTO as transitioning the VC technology identified, no formal business plans or proposals have been established to facilitate a program of this size.

C. STRUCTURING THE VC OVERSIGHT OFFICE

First and foremost, our research leads us to recommend that the CTTO office be put in charge of any Navy VC program because of its previous dealings with the VC community and its expertise in transitioning technology into the fleet. With that being said, this research also indicates that the current manning of the office precludes this organization from taking on this added responsibility. The CTTO simply does not have enough personnel to properly execute a VC program.

As of August 2005, the CTTO office had a staff of four with an annual budget of approximately $1,000,000.[179] If the proposed legislation is approved and allows the Navy to use $20,000,000 of unobligated balances for a VC initiative, the added responsibility of managing the funds and the VC program may exceed the CTTO's capabilities. As such, we recommend expanding the CTTO to include a VC Oversight organization. The notional mission of this organization is depicted in Figure 13.

178 It is worth noting that this problem was briefly addressed in the Navy legislation by stating that this would fall under the CTTO's area of responsibility.

179 WindyJoy Springs, Personal Interview, 16 Sep. 2005.

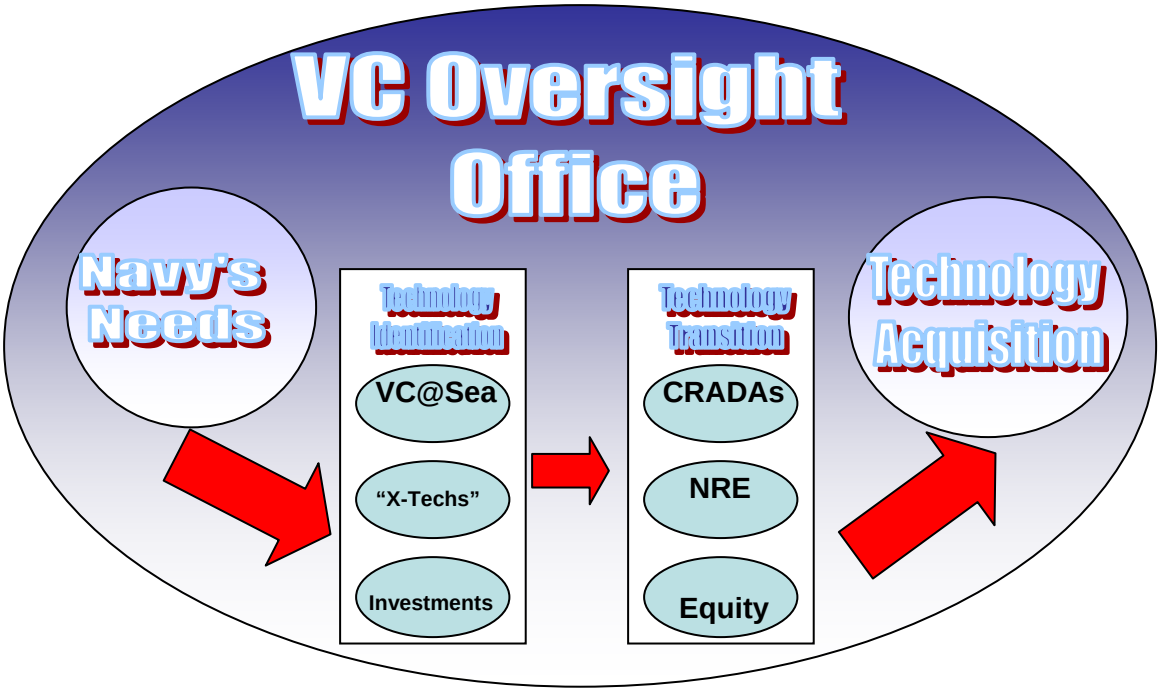

Figure 13. Proposed VC Oversight Office Business Cycle

D. MANNING

This proposed office could fall under the CTTO's area of responsibility and would supplement the current staff. To operate this VC office, we recommend a staff of four civilian personnel with the option of including two active duty personnel. The civilian personnel should all be senior civil servants who have an engineering background. An ideal candidate would also be someone who has experience dealing with small businesses and knowledge of how VC works. Interviews conducted with the CTTO suggest that the best candidate would have held the role of Science Advisor to the fleets or a program manager for an acquisition program. These two positions were identified because of the traits these positions required and the experience gained from these positions would add value to the VC Oversight Office.

The civilians that would compose the Navy VC Oversight office would have diverse duties. While the CTTO would decide on the work breakdown for the office, we have recommended the following chart as one possible way to structure the VC Oversight Office (Figure 14).

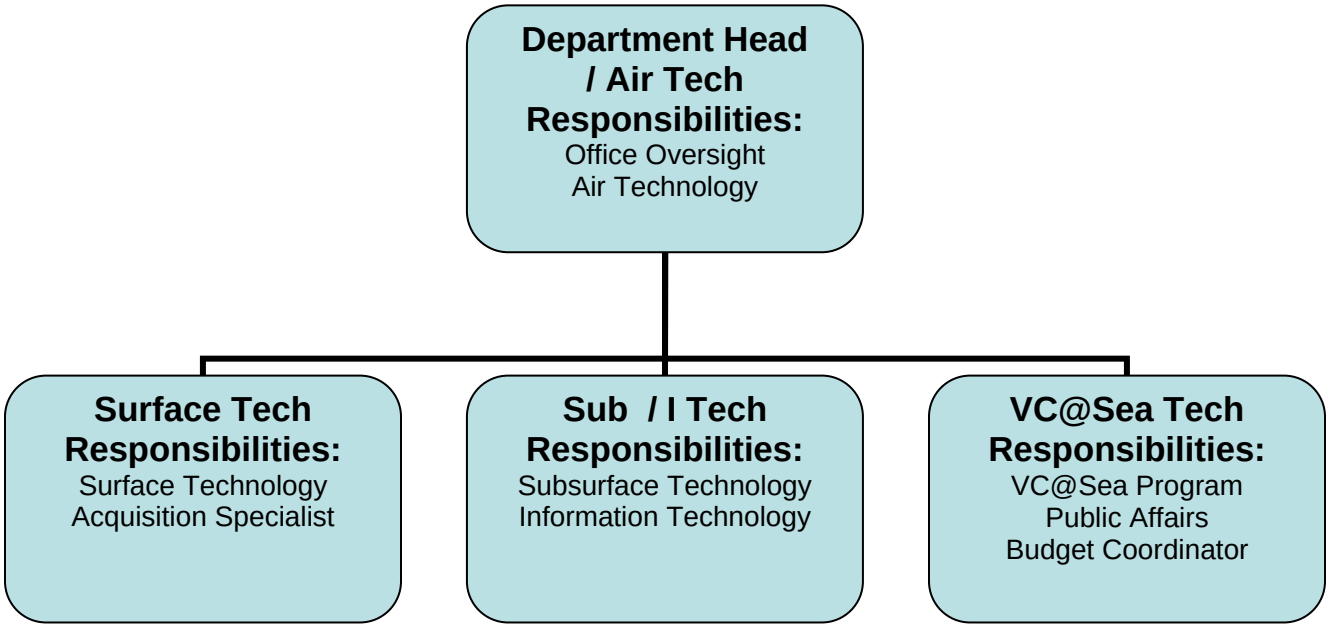

Figure 14. Proposed VC Oversight Office Structure

When assigning jobs to the personnel in this office, the initial idea would be to have each member focus on one or two warfare areas. This would not only allow each team member the ability to develop relationships with technology firms in the respective fields of interest to the warfare areas, but also develop specific knowledge of the needs of the Navy in that warfare area.

In addition to the civilian personnel, it is also recommend that two active duty personnel work with the VC Oversight Office. The logic behind this recommendation is that the Sailors and Marines will be the end-users of any technology identified by the VC Oversight Office and it would be useful to have a user's perspective on the Navy's needs and how possible technology could fill these needs. We understand that it will be impossible to have two active duty personnel represent all the views of the Navy and Marine Corps but in that most of the technology will be late stage technology, the active duty end users should be represented. In selecting the active duty representatives, the ideal candidate would be someone coming off an operational tour who has an engineering

background and possibly an MBA.[180] It is also recommended that the candidates be Line Officers for the Navy or Combat Arms Officers for the Marine Corps and be at least an O-3.[181] One possible option on how these two personnel could be assigned to this office would be though an internship sponsored by the Naval Postgraduate School. This program could be set up similar to the NPS Operations Research program's internships and allow for post operational tour personnel working on a master's degree to gain experience in VC and provide end-user input.

E. RESPONSIBILITIES

The proposed VC Oversight Office would have the following three main focuses with many responsibilities denoted under each focus area:

1. General Oversight and Administration of VC program
2. Reestablish and manage the VC@Sea program
3. Allow for (and manage) investments in current government VC programs such as *OnPoint* or *In-Q-Tel*

The first focus area, general oversight and administration of the Navy's VC initiative, is the most broad and most important to the overall health of the program. The responsibilities under this focus would entail the following:

- Creating a business plan that aligns the goals of the VC initiative to the Navy's needs
- Managing the VC budget
- Providing coordination services between the Navy and the VC community

180 We recommend an MBA because it provides a set of analytical tools for business and management decision making to the user which when combined with an engineering background, provides the best skill set for the VC industry.

181 While the ideal candidate would be a line officer, we also feel that selected Staff or Combat Service Officers would qualify if they had operational experience. In most cases, we also see the candidates being an O-4 but understand it may be difficult to get an O-4 to fill such a billet.

- Evaluating VC firms identified by the VC@Sea program (to be discussed in the following section), their business plans and their technology and provide additional funding to assist in transitioning the technology if feasible.

As with any VC program, location proves to be a critical aspect and this holds true for this office as well. As such, it is recommended that this office be located in California because of the proximity to the VC industry and the numerous Naval assets located throughout the state. As stated in Chapter II, California is the leader in VC investments. In 2004, $9.5 billion out of a total $21 billion (or 45%) of total VC investments were invested in California. The next largest percentage of VC funds invested by state was Massachusetts which had $2.7 billion or almost 13% of total VC investments.[182] Possible locations for this office in California include Silicon Valley (San Jose and surrounding areas), Monterey (as an institute at the Naval Postgraduate School) or San Diego.

Initially, it may seem that creating a new office within the CTTO but not located in close proximity to the CTTO would be a mistake. Research indicates that there is greater benefit to establishing an office located in close proximity to the VC firms thus helping to facilitate communication with the VC firms and technology companies. Research has also shown that VC firms are very interactive and as such require significant attention from the investors and directors. As noted in the first section of this paper, Gompers and Lerner have also come to this conclusion by noting that "more than half the firms have a venture director with an office within sixty miles of their headquarters, while 25 percent of the firms have a venture director within seven miles[183]." If the Navy wants to actively participate within the VC industry, it must create an office in such a location that will contribute to this interaction. Placing the new VC oversight office with the current CTTO would not encourage this interaction. By

[182] National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

[183] Paul A. Gompers, and Joshua Lerner, The Venture Capital Cycle, Cambridge Mass: MIT P, 1999.

locating the office in California, the VC Oversight Office would require less traveling resulting in greater efficiency due to reduced travel expenses and more time available for researching technologies.

At this point, it is also worth reminding the reader that it is recommend the VC Oversight Office fall under the CTTO because of the core competency that the CTTO has in identifying technology and transitioning that technology to the Navy. The CTTO is not an oversight office for the VC Oversight program, but an office that already has the knowledge required to start the program. As such, the VC Oversight office does not need to be co-located with the current CTTO.

The second focus area of the VC Oversight Office would be to reestablish the VC@Sea program which was previously the responsibility of the CTTO. This program was a great benefit to the Navy because it allowed the Navy to identify technologies coming out of the VC community by allowing the VC companies to see how the Navy operates. Responsibilities under this focus area include the following:

- Reestablishing the VC@Sea program
- Scheduling one to two VC@Sea visits a year
- Identifying potential VC firms that may have technology of interest to the Navy

The VC@Sea program would be the first step in transitioning technology or ideas to the Navy. The program would act as the liaison service that convinces the VCs to talk to the Navy. Once the technology has been identified through the VC@Sea program, then the VC Oversight Office would further evaluate the technology to see if the technology meets the Navy's requirements as is or if the technology could be adapted to meet the Navy's needs and required bridge funding to do so.

The VC@Sea program will be critical to getting the VC firms to talk to the Navy. Because of this, taking the VCs out to sea in a sort of TIGER cruise would go a long way towards establishing good will. A portion of the unobligated balances would be used to pay for the VC@Sea program. The majority of the costs for the program are expected to

come from transportation costs associated with transporting the personnel to and from the ships. Since most VC firms are located on the west coast, it makes sense to assume that most VC@Sea events should take place with 3rd Fleet ships.[184] This means that the VC@Sea program would need to closely align the program with 3rd Fleet's operations office in addition to the VCs expected to participate.

The final focus area of the VC Oversight Office could best be thought of as an optional focus, but one that we feel is important to consider. The VC Oversight Office should have the option of investing money in established Government sponsored VC programs such as In-Q-Tel or OnPoint as an additional way to gain access to new technology. These investments could be in coordination with established technology focuses that these firms have already invested in, or could be a new focus based on technology needs the Navy identified. These investments could compliment the VC@Sea program. Whereas the VC@Sea program would be an all encompassing overview of technology, investing in an already established VC firm could allow the Navy to focus on one specific industry.

There are numerous benefits that this type of investment could bring to the VC Oversight Office. The first benefit is that it would allow the VC Oversight Office to enter relationships with VC portfolio companies as investors as opposed to customers through the investment firm. Under the VC@Sea program, the Navy would be a potential customer to the VC firms. While the customer relationship would still allow the Navy to identify technology, that relationship would not give the Navy access to all of the information about the technology that the investors have access too. This additional information could also include industry information as well as information about competing products and technology.

184 Since most VC firms are located in California, the majority of VC@Sea programs would most likely be held within 3rd Fleet. This, however, does not mean that 3rd Fleet will be the exclusive host of the program. It should also be possible to host an event on the east coast as well if there is enough interest with east coast VCs.

A second benefit of these types of investments is that it would allow the Navy a way to make equity investments at a significantly reduced cost when compared to starting its own VC Company. These reduced costs would result from the following reasons:

1. Reduced overhead
2. Leveraging of existing investments
3. Possibility of reduced management fees based on investments

First, the equity investments made though an existing fund would make use of existing facilities and resources meaning that the Navy would not need to provide the start up capital required to establish such a program. Second, if the Navy chose, it could invest in existing technology focuses and leverage its equity investments off of current investments already placed in the industry. This would allow for more investments to be made in a given industry and therefore, increase the possibility of investing in a firm that becomes profitable.

The third cost reduction, when compared to creating a Navy specific VC Company, is that in many cases, the Navy could benefit from a declining management fee schedule that is present in such firms as OnPoint.[185] A declining management fee schedule means that as more funds are invested in the VC company, the percentage of the committed funds that are deducted as a management fee are reduced. (See figure 15) For example, if the Navy were to invest an additional $10 million into OnPoint, then the management fee paid would only be on the $10 million invested and would be based on the allocated amount at the end of the fee schedule.

[185] Jason Rottenberg, personal interview, Jun 2005.

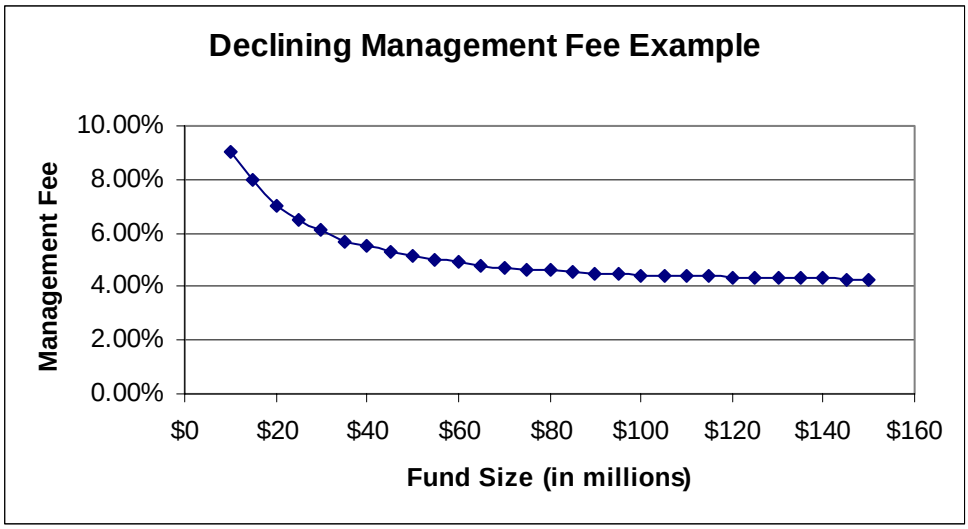

Figure 15. Declining Management Fee Example

If the VC oversight office chooses this option, then it would be responsible for identifying the industry sector in which it wanted to invest, and coordinating such investments with the respective VC program. Such investments will require significant capital outlays so the VC Oversight Office would need to consider this when planning its budget. The VC Oversight Office would also need to work with the VC firms once the technology is identified and help transition it to the Navy. If the goal of this investment is to simply identify technology, then the VC Oversight Office would need to assist in communicating the technology back to the CTTO and ONR. Again, the role will be to liaison between the Navy and the VC firms. Finally, the Navy will need to consider approval issues. These approval issues mean that the Navy would need to clear such investments through the VC firm's board of trustees, the VC firm's representative organization (Army for OnPoint or CIA for In-Q-Tel), and possibly Congress.[186]

F. EXPECTED BENEFITS OF A NAVY VENTURE CAPITAL OFFICE

The proposed structure of the Navy VC initiative as described previously allows for the following benefits when combined with the drafted legislation:

[186] Many of the benefits and considerations involving possible Navy investments in established government VC firms were identified during an interview with Mr. Jason Rottenberg on 21 Sep. 2005

- Provides infrastructure to allow unobligated balances to be put to best use
- Provides an avenue for VC firms and the Navy to communicate needs and technology
- Provides the Navy a means to gain access to new technology and transition technology to the fleet in a cost effective manner
- Allows the Navy to leverage off technology developed for the private sector.
- Eliminates the need for the Navy to establish its own VC corporation in order to gain access to new technology
- Provides the Navy the flexibility to identify technology across many sectors and transition specific technology to meet the fleet's needs
- Provides an avenue to invest in other Government VC programs to supplement the technology identified though the VC@Sea program

The biggest benefit of such a program is that it provides the Navy a means to put the unobligated balances that the Navy legislation proposes to the best use. Without a dedicated infrastructure, the Navy currently does not have the means to properly employ the unobligated balances. If the proposed legislation is passed and the Navy does get access to the unobligated balances, we have found no business plan that specifies how the funds will be used. As such, our proposed program would allow a specific office to coordinate the Navy VC effort.

The second biggest benefit of such a program is that it would provide the Navy with the means to communicate its needs to a new market, and one that has, for the most part, remained untapped. As the first section of this paper described, the VC industry has been responsible for numerous innovations in recent years. The current Navy acquisition structure fails to identify this market. A Navy VC Oversight Office when combined with funding to support the office could establish a dialogue with the VC industry. The dialogue with this industry is an important first step in identifying new technology.

The third benefit, closely related to the second, is that the proposed program could provide a means to identify and transition technology. Currently, the Navy acquisition system operates by identifying needs and seeing if internal capabilities exist that meet

the needs. If they do not, then the acquisition process starts by going to the private sector to develop a technology to meet the requirements previously identified. The proposed program of creating a VC Oversight Office attacks this problem in a much different way. Instead of identifying needs internally, by inviting VC firms to the fleet to observe how we operate and then asking them "What do you have that will allow us to do our jobs better?", the Navy now would have a new group of people who could identifying technology for them. This is a revolutionary way of attacking an old problem.

The fourth benefit of such a program is that it could allow the Navy to leverage technology being developed for the commercial sector. Much of what the Navy does has a close parallel in the private sector. From database management to healthcare to wireless networks, many of the problems that the Navy is facing are also problems for private sector companies. The VC firms that invest in companies developing solutions to these problems could find a new market for the technology in the Navy. The Navy, in turn, would have access to people who are already addressing problems the Navy is facing. The Navy VC Oversight Office would provide a means to communicate with companies developing solutions to problems facing not only the private sector, but the Navy as well.

The fifth benefit is that our program would give the Navy the ability to communicate with the VC community without establishing its own VC company. While the Army (through OnPoint) and the CIA (through In-Q-Tel) have been successful in accessing the VC industry through their own internally established VC company, research indicates that starting a Navy specific VC would require a substantial increase to the funds being considered for this type of program.[187] Calculations shown in Appendix B highlight this point in more detail and show that while the average VC fund size in 2004 was around $155 million, the technologies that the Navy is interested in are associated with significantly larger funds. Because of this, the Navy must find new ways to access this market and our program provides a means to do this.

187 Appendix B

The sixth benefit of the model is that it is designed to be flexible. The proposed Navy VC Oversight Office would act much like a tool box that has numerous tools the Navy could use to identify and transition technologies to the Navy. These tools include, but are not limited to, the VC@Sea Program to identify technologies, the engineering team to evaluate the technologies and provide opinions, CRADAs to provide funding to further develop the technologies, the VC Oversight Office to provide liaison services and the option to invest in other Government VC programs as an additional means to new technology. The Navy VC Oversight Office would also allow the Navy to decide on its technology focus and not be limited to one specific industry sector.

If, on the other hand, the Navy does want to focus on a specific sector, the model would allow for the Navy VC Oversight Office to invest in other government VC firms that have specific focuses such as OnPoint within the power and energy industry or In-Q-Tel within the computer and database management sectors. As opposed to starting a specific VC company to do this, the Navy could leverage off of other firms to gain access to the technology. Again, this would provide another avenue for investments and increases flexibility.

G. CHALLENGES IN ESTABLISHING A NAVY VC OVERSIGHT OFFICE

With the reasoning for the Navy VC program and the benefits of such an approach already established, this section will address the challenges the Navy (or more specifically the CTTO) will face in trying to establish such a program. Specifically, the following issues will be addressed:

- Organizational Roadblocks
  - Developing a Business Plan
  - Funding
- Expected Costs

1. Organizational Roadblocks

Currently, the CTTO is a small office with a staff of four and an annual budget of approximately $1 million dollars.[188] If this office were to be expanded and given a new budget representing up to $20 million in new funding, other offices may try to gain access to the funding. This could make if difficult for any program to succeed if there is not guidance on to whom the funding would specifically go.

These organizational conflicts could also cause problems in trying to define a business plan for the VC Oversight Office.[189] A well defined business plan is one of the most important aspects for the Navy VC Oversight Office to establish early on because it would guide the direction of the Navy VC program. This business plan will need to align with the mission of ONR in such a way that it adds to ONR's mission without overlapping with ONR current programs.

2. Financial Considerations

Aside from internal frictions, the financial considerations will be another obstacle in properly executing a Navy VC program. Initially, it may seem that the legislation will address this aspect of the program, but the proposed legislation can be left open to interpretation which could slow the Navy VC program down considerably. The first issue involves how the money can be used. As previously identified, the proposal specifies that the funding will be made available for a "Navy Venture Capital Engagement demonstration," but does not clarify in significant detail, how the program

188 WindyJoy Springs, personal interview, 16 Sep. 2005.

189 The following section of the paper will go into more detail on how the Navy VC Oversight Office should approach the development of a business plan. This section is only meant to identify the business plan as one of the challenges that must be overcome if the office is to succeed.

should be carried out.[190] If the CTTO does get jurisdiction over the Navy VC program, then the next problem becomes how it could use the funds to support such a program.

Previously in this paper, it was identified how the CTTO office could be expanded to carry out the expanded mission of a Navy VC program. How the CTTO could cover the cost of the additional resources required is not clear. The table on the following page (Table 2) depicts the notional costs to run the Navy VC Oversight Office for one year.

Category			**Cost**
Funding for 4 FTE[191]	Salary	40% Benefits[192]	
1 GS-15	$128,383	$51,353.20	$179,736
3 GS-14	$109,142	$43,656.80	$458,396
Travel for Staff[193]			$200,000
Rent for Office[194]	1300 sq ft @ $3900 / mo		$46,800
Utilities	$500 / mo		$6,000
Support Costs[195]	$2000 / mo		$24,000
Total[196]			**$914,933**

Table 2. Estimated Expenses for a Notional VC Oversight Office

190 Appendix A. The draft legislation states that the Navy will use a three part process which involves identifying technology though the Navy Research Advisory Council (NRAC), have funds set aside to test emerging technology identified by the NRAC, and transition the technology to the Navy through the CTTO. We feel that this legislation may be too vague because it does not identify who will be overseeing the process and controlling the funds.

191 Based on the locality pay area of San Jose; Source: http://www.opm.gov/oca/05tables/html/sf.asp

192 40% estimated based on NPS budgeted costs for civilian benefits; Source: Mr. Jeff Rothel

193 Estimate seven trips per year per employee to visit VC portfolio companies, System Commands (SYSCOMS) and scout technology. Also includes travel associated with VC@Sea program; Source: Ms. WindyJoy Springs

194 Estimate based on rental rates for office space in Palo Alto area. Source:

Jocelyn Dong "Space Available." Palo Alto Weekly 16 Feb. 2005. 10 Oct. 2005 <http://www.paloaltoonline.com/weekly/morgue/2005/2005_02_16.office16.shtml>.

195 Support Costs consist of office supplies, marketing material, phone bills and other operational expenses.

196 Figure does not include one time costs to establish office such as copier, computers, phones and office furniture.

While it is relatively easy to develop estimates for the cost, it is less clear as to how these costs can be covered. The draft appropriation allows for the unobligated balances to be used as general RDT&E funds consistent with the regulations governing the use of such funds. The DODFMR Vol. 2A specifies the following regarding the use of such funds:

> DODFMR Vol. 2A 010213(B)(1)[197]
> a. RDT&E will finance research, development, test and evaluation efforts performed by contractors and government installations, including procurement of end items, weapons, equipment, components, materials and services required for development of equipment, material, or computer application software; its Development Test and Evaluation (DT&E); and its Operational Test and Evaluation (OT&E) as provided for in paragraph C.5. (Test Articles and Test Support) below.
>
> b. The operation of R&D installations and activities engaged in the conduct of R&D programs, including direct and indirect efforts, expense and investment costs.
>
> DODFMR Vol. 2A 010213(B)(2)[198]
> d. Expenses of Headquarters R&D management, organizational management analyses, test and evaluation for system sustainment personnel and command support, and product improvement within the current performance envelope for systems out of production will be funded in the Operation and Maintenance (O&M) appropriations.

At first glance, it would appear that the Navy VC Oversight Office would be classified under DODFMR Vol. 2A 010213(B)(2)(d). Under this classification, appropriated Operations and Maintenance funding would be required to fund such costs. Upon further research, it appears that the funds provided for a Navy VC demonstration would fall under DODFMR Vol. 2A 010213(B)(1) and as such, would be available to cover the cost of operation for a Navy Venture Capital Oversight Office. These funds

197United States, Office of the Under Secretary of Defensse (Comptroller), Department of Defense, Department of Defense Financial Management Regulations, Oct. 2005, 30 Oct. 2005 <http://www.dod.mil/comptroller>.

198 United States, Office of the Under Secretary of Defense (Comptroller), Department of Defense, Department of Defense Financial Management Regulations, Oct. 2005, 30 Oct. 2005 <http://www.dod.mil/comptroller>.

could be used for this purpose in accordance with the Financial Management Policy Manual Section 075403, p 3-195 and Title 10; Subtitle C; Part I; Chapter 503 § 5023(a)(1-3) which states: [199]

> (a) Sums appropriated for the Office of Naval Research may be used to pay the cost of performing its duties under section 5022 of this title including the cost of—
>
> **(1)** administration;
>
> **(2)** conduct of research and development work in Government facilities; and
>
> **(3)** conduct of research and development work under contracts with individuals, corporations, and educational or scientific institutions.

Having these funds available for the Navy VC Oversight Office overcomes, what could have been, a serious hurdle for such a program. With this clarification, the VC Oversight Office could create a budget to cover the costs and use any remaining funding to research VC firms and transition technology. Now, the subject of funding must transition from how the funds could be used to accountability on the part of the VC Oversight Office to properly use the funds. While the VC Oversight Office should have a great amount of flexibility in using these funds, both ONR and the CTTO need to establish metrics to guide the VC Oversight Office in the use of the funds prior to engaging in a Navy VC demonstration.[200]

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[199] United States, House of Representatives, Title 10 United States Code 5023c(I)(503), 12 July 2005, 1 Sep. 2005 <http://straylight.law.cornell.edu>.

[200] The topic of measuring how the funds are to be used and the resulting benefits are a subject that goes beyond the scope of this paper. For this section, we are listing this as something for ONR and the CTTO to consider prior to entering a Navy VC demonstration. The subject of metrics that can be implemented for the VC Oversight Office are a possible topic for follow on research.

H. RECOMMENDATIONS ON HOW TO MARKET THE NAVY VC OVERSIGHT OFFICE

The biggest challenge in establishing the Navy VC Oversight Office at this stage is not the funding or financing challenges, but convincing all interested parties that this is the right course of action for the Navy. VC is currently a hot topic not just in DoD, but the entire government. Over the past year, government involvement in the VC industry has attracted much attention, as evidenced by a Wall Street Journal article on *In-Q-Tel* published on September 12, 2005.[201] This attention seems to make the policymakers nervous about any government interaction with the VC community.

Even with the outside political sensitivity being noted, research indicates that there are three directions in which the Navy needs to market the Navy VC program; one directed internally at the Navy, one directed to political interests, and one directed at the VC industry. The following provides recommendations on how to market the Navy's VC Oversight Office allowing buy in from all stakeholders.

1. Marketing the Navy VC Program Internally

The first topic that will be addressed is the internal marketing challenges specifically directed at ONR. If the proposed legislation is approved and the CTTO receives additional funds, there will be some discussion within ONR as to who will control the money. The first marketing goal should be focused on identifying the VC Oversight Office's mission within ONR and the CTTO. The objective of this marketing should be to identify all interested parties so the VC Oversight Office is not duplicating efforts of existing ONR programs. The best way to do this is by creating a business plan for the VC Oversight Office and discussing the plan with senior ONR officials.

The business plan will be the first step in identifying the VC Oversight Office's mission and establishing good will in ONR. The business plan will need to focus on the VC Oversight Office's mission and make sure that the mission does not interfere with

201 Jay Solomon, "Intelligence Investing," The Wall Street Journal 12 Sep 2005, sec. A: 4.

other ONR activity. When briefing the business plan, the VC Oversight Office can also get input from the ONR officials on technology focus areas it feels the VC program should focus on, and ask if there are missions where current ONR research can benefit from VC technology.

It is important to remember that the VC Oversight Office would act as a liaison between the VC companies and the Navy. One of the main interaction points within the Navy will be ONR so it is important that the Navy VC program stay aligned with ONR. We believe that this program can facilitate alignment of goals between the CTTO and ONR with respect to developing a VC program that meets the needs of the Navy. The VC program should reinforce the idea that it is not competing with the traditional ONR mission, but supplementing the mission to bring more technology to the table.

2. Marketing to Political Interests

The second marketing program which must be considered is marketing the VC Oversight Office to political interests. This needs to be considered because it was congressional verbiage in the 2003 House Appropriations Act that directed "the Assistant Secretary of the Navy for Research, Development and Acquisition, and the Director of the Office of Naval Research to jointly prepare a report for the Committee which examines whether the Navy could benefit from establishing a pilot venture capital fund to enable program managers to take advantage of higher risk technology developments in a rapid fashion without fear of penalty to their existing programs."[202] The verbiage goes on to recommend a study of a program similar to the In-Q-Tel model in addition to other private VC models for implementation in the Navy.

Because of the congressional interest in the Navy program, the Navy must be ready to market its program to Congress. Based on the 2003 Appropriations Bill which directed the Navy to study a VC program, it can be understood that Congress was looking for a Navy specific VC company similar to the OnPoint model which represents the

[202] Jerry Lewis, United States, Cong. House, DEPARTMENT OF DEFENSE, 107 Cong., 2nd sess., 532, 25 June 2003, 27 Oct. 2005 <http://www.thomas.loc.gov>.

Army. In that we are not recommending such an approach to VC for the Navy, the Navy must be ready to defend its program to Congress.

The best way for the Navy to market the VC Oversight Office is to focus on the uniqueness of the program. The model we are presenting in this section is not a copy of an existing model, but one that would be uniquely suited to the Navy's needs. The VC Oversight model could bring all of the benefits of a Navy specific VC firm with more flexibility that would allow the Navy a greater degree of control over the technology focus. This added flexibility will stem from the tools available to the VC Oversight Office to include CRADAs, Nonrecurring Engineering funding, and Equity Investments though OnPoint or In-Q-Tel. The added controls will be the result of the ONR (though the VC Oversight Office and the CTTO) controlling the funding.

The focus of marketing to political interests must address the benefits the program can bring to the Navy in relation to the Navy's goals of identifying technology and then transitioning promising technology to the Navy. The CTTO had a great track record of transitioning technology as evidenced by its 55 deals completed through 21 March 2005.[203] The Navy will need to stress this previous success and then show how the VC Oversight Office will build on this success with the additional resources the proposed legislation would bring.

3. Marketing to the Private Sector

The third and final marketing challenge will be an external marketing program directed at the VC firms. This mission will fall more in line with the traditional picture of marketing because its goal will be to inform a specific population about a service that the Navy is offering. It will require the Navy's VC program to define a target market, inform the target market, communicate the Navy's mission to the target market, and establish relationships with firms in the target market with the hopes that both parties will be better off for having engaged one another. It can be assumed that most small,

[203] Michael McGrath "Alternatives for Increased Navy Participation with the Venture Capital Community." Assistant Secretary of the Navy (RDA). Pentagon, Washington DC. 21 Mar. 2005.

private VC firms will have concerns about working with the Navy and this will be the most difficult hurdle to overcome.[204] As such, the best way for the Navy to approach this problem is to structure the Navy VC program as a type of "business".

This "business" will not be a traditional business, but instead would allow the Navy to structure the VC Oversight Office in such a way that it resembles a business. This will be the best way to get interaction among the VC firms and market the program to the private sector business in a way they can understand. The following section describes our recommendation on how to accomplish this.

I. THE *VECTOR* MODEL

Our recommendation is for the Navy VC Oversight office to be called VeCTOR for Venture Capital Technology Transition for Operational Requirements. As stated earlier in this chapter, it is recommended that the VeCTOR office be established somewhere on the West Coast to allow for more interaction among the VC firms. Possible locations include San Diego, Monterey, or San Jose. The physical office will play a big part in how the program is interpreted by the VC community. The best case scenario is a location that allows the VC firms to come by to present their technology in a business setting. The location also needs to encourage the VeCTOR personnel to conduct site visits with VC firms.

Once a location is established, the VeCTOR team needs to be proactive in informing the VC industry about the program. It can do this through trade shows, industry magazines and publications such as Red Herring and The Wall Street Journal, and through contacts in other government VC programs.[205] In the VC industry, word of

204 Based on interviews conducted with numerous VC fund directors.

205 While it may seem optimistic to assume that financial publications such as Red Herring or The Wall Street Journal may be interested in the Navy's model, there has been much attention in recent times to government interaction in the VC community. Based on this interest, we feel that the Navy may be featured in such publications.

mouth seems to be the way to get things done and VeCTOR needs to capitalize on this.[206] One or two deals with a few big VC firms would get the word around quickly about the program.

VeCTOR will also need to have publications describing itself to the target market. These publications need to describe the VeCTOR model, how VeCTOR interacts with the Navy, on how to market products to VeCTOR and the potential market that VeCTOR represents.

The last point is very important because it means that the Navy needs to understand its customer. The venture capitalists are first and foremost, business personnel. They are not in it for the technology. They will be looking for a market for their product and VeCTOR will need to convince them that the Navy is a big enough and suitable potential market for them.

Finally, one of the biggest marketing tools that VeCTOR will have will be the VC@Sea program. VeCTOR will need to realize that the VC@Sea program is more than just a way to identify potential technology. Much like the Navy does with its recruiting ads, VeCTOR needs to market the VC@Sea program as an exciting trip which can show the VC firms the market that VeCTOR represents.

The VC@Sea program is unique in that it will allow the VC firms to get a first hand look at what the Navy does and how both parties can benefit from the interaction. The Navy can identify and get access to new technology, while the VC firms may be able to secure additional research funding and gain access to a new, largely untapped market. This represents a huge marketing opportunity that VeCTOR must use to its advantage.

206 Karthic Jayarman, personal interview, 18 June 2005; Howard Strateman, personal interview, 18 Jun 2005; and Jason Rottenberg, personal interview, June 2005.

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VI. CONCLUSIONS

The original Navy VC idea was first introduced by Congress in the 2003 House Appropriations Bill. In that bill, the Committee directed "the Assistant Secretary of the Navy for Research, Development and Acquisition and the Director of Naval Research to jointly prepare a report for the Committee which examines whether the Navy could benefit from establishing a pilot Venture Capital fund to enable program managers to take advantage of higher risk technology developments in a rapid fashion without fear or penalty to existing programs."[207] Since that report was published, there has been a fair amount of research done on the subject of establishing a Navy VC program. This research includes not only the original report, but DoN interaction with the Navy Research Advisory Counsel Venture Capital (NRAC VC) Panel chaired by Dr. Mark Lister and this report.

Even with all of the research completed up to this point, there still appears to be no consensus as to what course of action the Navy should undertake. On July 13, 2005, the NRAC VC panel had its "final" meeting with the Navy's leadership where it put forth it's recommendation on how the Navy should proceed with the VC engagement demonstration. Overall, the panel recommended that the Navy not undertake a VC program because the goals were too undefined and there were no firm resources that could be dedicated to the project.

While the NRAC VC Panel did not support the Navy entering a VC program, the research presented in this paper takes a different view. As the result of thinking about the Navy VC program as a program that does not need to fit in the traditional VC mold, we have actually expanded on the NRAC VC Panel's conclusion. The recommendations presented in this paper differ from those of the NRAC VC Panel with respect to overall involvement in the VC industry, but both agree that a Navy specific VC fund is not needed.

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207 United States, Cong. House, Department of Defense Appropriations Bill, 2003, 107th Cong., 2nd sess., 532, 25 June 2003, 9 Oct. 2005 <http://thomos.loc.gov>.

A. NAVY INVOLVEMENT IN VC

The ideas presented in this paper obviously support the Navy undertaking a VC program. How did the research presented here lead to this conclusion when research conducted at the same time by actual venture capitalists reaches an entirely different conclusion? The first answer is that the research presented in this paper did not come to an entirely different conclusion. With respect to the Navy starting a Navy specific VC firm, both the NRAC VC Panel and this paper recommend against it. Where this paper does differ from the NRAC VC Panel is that it recommends Navy involvement in the VC industry, albeit, though a different model than traditionally used in VC.

The benefit of this research is that beyond recommending that the Navy should enter the VC industry, it recommends a model that can fill the Navy's needs with respect to VC and, hopefully, accomplish the Navy's objectives. The model presented is unique to the Navy and specifically tailored to meet the Navy's VC goals while adhering to the proposed legislative language. The model is not a typical VC model and as such, may not have been considered by the NRAC VC Panel.

B. THE VENTURE CAPITAL INDUSTRY

Before recommending what action the Navy should take with respect to VC, the first objective of this paper was to define VC. Over the course of the past ten years, the VC community has received a great amount of publicity. From the technology boom of the late 1990's to the "dot com" crash in 2000-2001, VC has been on a roller coaster ride that the market watchers have been following. All of this attention and publicity seems to have had the effect of blurring the definition of VC to the public. Because of this, Chapter II of this paper was dedicated to defining the VC industry and understanding how it operates. That chapter covered the history of VC, the performance of VC firms, how VC firms are structured, how VC firms are compensated, how VC firms invest money, how VC firms oversee investments and how VC firms exit investments.

One of the main ways research was accomplished for this section was going out and speaking with venture capitalists outside the government's influence. It was

important to get a feel for the industry beyond what academic papers and books on the subject could provide. While most of the cited sources in Chapter II do come from published works, the information gained by conducting visits with venture capitalists helped conceptualize the VC industry to understand how the Navy's goals could relate to the industry. From this point, the next step in the research was addressing government involvement with the VC industry.

C. GOVERNMENT VENTURE CAPITAL INITIATIVES

While the Navy currently does not have a dedicated VC program, numerous government programs have attempted to tap into the VC community. Chapter III of this paper focused on identifying the government initiatives that work with (or have worked with) the VC industry, or firms that are targeted by VC companies. This chapter was intended to assist the reader in identifying the Navy's objectives with VC by identifying other DoD initiatives that had similar objectives and analyzing the results. Another benefit of this chapter is that it identified potential models that the Navy could use if a decision was made to develop its own VC program.

Site visits were also conducted with active government VC initiatives. These site visits included:

- In-Q-Tel – The CIA's VC program
- OnPoint – The Army's VC program
- CTTO – The Navy's Commercial Technology Transition Office
- DeVenCI – Defense Venture Catalyst Initiative

The real benefit of these visits is that they solidified the goals of the government agencies with respect to VC and showed how the government VC programs attempted to align these goals with the programs. Once the industry and the government VC initiatives were analyzed, the next focus would be discussing options for Navy involvement in VC.

D. OPTIONS FOR NAVY INVOLVEMENT IN VENTURE CAPITAL

Chapter IV focused internally on the Navy. The question was, should the Navy enter the VC community, and if it should, what models could be presented that would allow it to do so? In order to answer these questions, the research first had to focus on what are the Navy's technology needs and whether VC could assist the Navy with these needs. This seemingly straight-forward question turns out to be extremely complex. This complexity stems from the sheer size of the Navy and its mission and how the missions are interpreted by different organization within the Navy.

For some organizations, the Navy's technology needs are to transition forthcoming technology not visible to the Navy from the commercial sector to the fleet. To others, the goal is to simply learn about technology being developed in the commercial sector and see *if* the technology holds value to the Navy. While these objectives seem similar, they are quite different in how they align with the VC community's objectives.

The good news is that this research did identify a common thread within the Navy, that being technology identification. The bad news is that corporate VC models do not align with *just* technology identification. This seems to be the point where the NRAC VC Panel came to its conclusion. This is also the point where this paper expanded the definition of Navy VC involvement by presenting models other than starting a Navy specific VC firm. The NRAC VC Panel and this research both agree that if technology identification is the only common goal, there are better ways to do it than by starting a VC firm.

E. RECOMMENDED ALTERNATIVE FOR THE NAVY VENTURE CAPITAL PROGRAM

With the differences up to this point accounted for, Chapter V presents the recommended approach to a Navy VC program. This chapter holds real value to the Navy because it contains recommendations as to how the Navy could enter VC. Research on the Navy VC program, to date, has not provided a recommended way for the

Navy to enter VC other than through vague guidance in Congressional legislation. The objective of this chapter was to mold a Navy VC program in keeping with the scope of the VC industry, the objectives of the Navy and the drafted legislation before Congress.

The model presented in our recommendations is unique to the Navy and meets all of the above requirements. Further, the model builds on core competencies already present in the Navy. Also identified are the challenges of establishing such a program. This paper presents a workable solution to the Navy for entering the VC industry.

F. FUTURE ISSUES WITH NAVY VENTURE CAPITAL

While this paper has identified if and how the Navy could enter the VC community, it has also raised a number of new issues that remain unanswered. The first issue is the "jointness issue", an issue which all DoD components must grapple with. This refers to the fact that DoD components need to think about jointness and not just unilaterally. Over the past decade, DoD has been successful with this endeavor by designing common weapon systems, common support systems and joint commands. It is therefore, only natural to ask about a joint DoD VC program as opposed to the piecemeal programs currently under study.

This is a noteworthy area for future research, but even so, there are a few points that can be addressed right now. First, there are DoD programs underway in this area that were not discussed. The most notable being the DeVenCI program headed by Dr. Steven King.[208] This program was not presented in this paper because there is currently no information available to the public on the final version of the program. From the little research that has been gathered, the program is intended to be a VC *initiative*, vice a VC fund. This means that one of the goals of the program will be to align DoD needs with respect to VC. The business plan on how this is to be done is still under development.

[208] Dr. King was interviewed for this paper and supplied us with the preliminary business plan for DeVenCI. At the time of writing, the final version of the business plan was not available and we were told by Dr. King that it may differ significantly from the original plan. As such, we chose not to include DeVenCI in Chapter III, but instead, note it here as a possible model for future study.

Aside from DeVenCI's efforts, aligning all DoD components under one VC program will not be an easy task. If trying to align the Navy's VC goals is a challenge, trying to do it for all of DoD would require a herculean effort. The biggest issue is that each component will have its own needs based on the unique missions assigned to them. This large scope clashes with the specific focus normally found in VC programs. This is not to say it will be impossible, but it will require a monumental undertaking with the full support of all services if it is to succeed.

The second issue, which can be related to jointness, is the funding issue that presents itself when dealing with VC in DoD. A stumbling block for the Navy, funding will be even more difficult when considering a joint DoD VC program. As stated in previous chapters, one of the main reasons that this research recommends against establishing a Navy specific VC firm is the capital requirements that such an undertaking require. In 2004, the average VC fund size was over $155 million dollars with over 29% of funds having over $250 million.[209] The size of a fund correlates to how managers place investments. A typical VC fund has a "hit ratio" of 10%, i.e. only one out of every ten investments proves to be profitable.[210] With such a low "hit ratio", VC funds need to place multiple investments to stand a reasonable chance of remaining profitable.

Relating this to the Navy, one of the biggest problems that this research found was the funding proposed for allocation to the VC program would not support the type and number of investments required in a VC fund. As such, future research needs to identify a "critical mass", which is an amount of money that would be required to sustain such a program. Future research could analyze what this critical mass needs to be for not just for a Navy program, but for a DoD wide program.

[209] National Venture Capital Association Yearbook, New York: Thomson Venture Economics Information, 2005.

[210] Based on interviews conducted with venture capitalists

G. CONCLUDING THOUGHTS

This research determined that the Navy could benefit from a VC program. The VC community has gained a reputation in recent years as being a cradle for technological innovation. The research presented in this paper suggests that the Navy could capitalize on this without starting is own VC fund. While starting a Navy VC fund could also satisfy the Navy's VC objectives, there is too much ambiguity in what the technology focus should be and how such a program should be funded. As a result, the Navy should limit its VC program to expanding current programs in ONR though the drafted legislation currently before Congress.

Additionally, this research determined that it will take more than just funding to create a successful Navy VC program. While the draft legislation before Congress is an important step, an infrastructure must be in place that will allow the money to be put to the best use. The Navy currently has the knowledge in the form of the CTTO to properly use the funding for VC, but in order for this to happen, there needs to be specific legislation that identifies an office in ONR to implement the program. The Navy does not need a specific VC firm to properly execute a VC program. It does need a dedicated office to control the funding if it wishes to gain full advantage of what the VC community has to offer.

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APPENDIX A[211]

NAVY PROPOSED VC LEGISLATION

LegProp07-06

SEC. XXXX. NAVY DEMONSTRATION OF PARTNERING WITH VENTURE CAPITAL-BACKED SOURCES OF INNOVATIVE TECHNOLOGIES .

Section XXXX. (a) Navy Demonstration of Partnering with Venture Capital-backed Sources of Innovative Technologies.—Of the funds made available for "Research, Development, Test and Evaluation, Navy", $20,000,000, as specified in subsection (b) shall be available to the Secretary of the Navy only for the purpose of funding a Navy Venture Capital Engagement demonstration as defined in Navy's response to the Fiscal Year 2003 House Appropriations Committee Report 107-532 request.

(b) Funding.-- During the current fiscal year and subsequent two fiscal years, notwithstanding any other provision of law, the Secretary of Defense may transfer not more than $20,000,000 of unobligated balances remaining in a Research, Development, Test and Evaluation, Navy appropriation account at the end of the last fiscal year before the account closes under section 1552 of title 31 United States Code, to a current Research, Development, Test and Evaluation, Navy appropriation account to be used only for the Navy Venture Capital Engagement demonstration. *Provided*, The amount specified in subsection (a) shall be derived from amounts previously available to the Navy for Research, Development, Test and Evaluation except for amounts for research projects designated as congressional special interest items: *Provided further*, That any such transfer shall be made not later than September 30 of each year. : *Provided further*, That funds so transferred shall be merged with and shall be available for the same purposes and for the same time period as the appropriation to which transferred: *Provided further*, That the transfer authority provided in this section is in addition to any other transfer authority available to the Department of Defense: *Provided further*, That no funds for programs, projects, or activities designated as special congressional interest items in DD Form 1414 shall

[211] This appendix presents a proposed version of the Navy VC legislation. It is presented in this paper only to allow the reader insight into the possible resources the Navy may allocate to the VC program. This language has not been approved by Congress.

be eligible for transfer under the authority of this section: *Provided further*, That any unobligated balances transferred under this authority may be restored to the original appropriation if required to cover unexpected upward adjustments.

(c) Report.--The Secretary of the Navy shall provide an annual report to the House and Senate Appropriations Committees describing the sources and amounts of funds transferred, summarizing the projects funded under this demonstration program (including the name and location of project sponsors) to date, a description of the major program accomplishments to date, and an overall assessment of the benefits of this demonstration program compared to the goals expressed in the legislative history accompanying this legislation.

Section-by-Section Analysis

Section XXXX (a) establishes for the Navy an authority similar to that provided for the Army Venture Capital Fund demonstration by Public Law 107-248, Sec 8105.

This section establishes a Navy Demonstration of Partnering with Venture Capital-backed Sources of Innovative Technologies and makes up to $20,000,000 available to the Secretary of the Navy for the current fiscal year and for each of the next two fiscal years for the purpose of funding a Venture Capital Engagement demonstration.

The purpose of this Venture Capital Engagement demonstration is to carry out, on a pilot basis, the plan outlined in the Department of the Navy's Report to Congress required by the Fiscal Year 2003 House Appropriations Committee Report 107-532 (p. 262). Consistent with that report, the Navy has initiated a three-part process by which it will promote a more rapid introduction of innovative technologies to meets its needs and enlist the perspectives and insights of the venture capital technology community. In the first phase (completed in 2005), the Navy established a venture capital panel of the Naval Research Advisory Council (NRAC). The NRAC panel advised the Navy to use the venture capital community's visibility of emerging commercial technologies to identify pre-production prototypes of potential Naval interest, and to invest in product testing, thereby positioning Navy to be a smart buyer and early adopter. In the second phase, Navy will implement this recommendation through Cooperative Research and Development Agreements (CRADAs) or other relationships with firms in the venture capital community, and will use the funds made available by this authority to test emerging technologies, evaluate them for potential Naval use, and provide feedback to product developers and Naval requirements organizations. In the third phase, the Commercial Technology

Transition Office (CTTO) of the Office of Naval Research (ONR) will accelerate transition of technologies into Naval programs of record by using the funds made available by this authority for product qualification and platform integration.

Section XXXX (b) places limitations on this authority. The Secretary of Defense may transfer not more than $20,000,000 of unobligated balances remaining in a Research, Development, Test and Evaluation, Navy appropriation account during the last fiscal year before the account closes under section 1552 of title 31 United States Code, to a current Research, Development, Test and Evaluation, Navy appropriation account to be used only for the Navy Venture Capital Engagement demonstration. The Secretary of Defense is limited as to the time, purpose and type of funds that can be transferred.

Section XXXX (c) requires the Secretary of the Navy to submit an annual report to the House and Senate Appropriations Committees describing the sources and amounts of funds transferred, summarizing the projects funded under this demonstration program (including the name and location of project sponsors) to date, a description of the major program accomplishments to date, and an overall assessment of the benefits of this demonstration program.

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APPENDIX B

In order to better understand the VC industry, it is important to understand how the size of a VC fund relates to the industry in which it invests. The size of a VC fund greatly influences how the fund is put to use. The size of a fund influences not only the size of the investments made but also the number of investments a fund can make and the number of industries in which it can invest. Based on research conducted with venture capitalists, the fund size proves to be one of the most important aspects to consider when raising a fund. Because of this, it is important to consider fund size with respect to any possible Navy VC fund.

A. AGGREGATE FUND DATA FOR FUNDS THAT INVESTED IN INDUSTRIES OF INTEREST TO THE NAVY

In order to analyze fund size with respect to a potential Navy VC fund, the first objective was to define what industry areas the fund would likely be investing in. After researching this through the CTTO's website, a list was compiled of possible Venture Economics Industry Codes (VEIC) to classify what industries a Navy VC fund might want to invest in.[212] This list includes the following industries:

- VEIC 1510 – Local Area Network Technology
- VEIC 1600 – Satellite Technology
- VEIC 1800 – Defense Communications
- VEIC 3200 – Batteries
- VEIC 3300 – Power Supplies
- VEIC 3810 – Military Electronics
- VEIC 3835 – Security and Sensors

After this list was compiled, the next step was to research investments made into these industries. To do this, the Thomson Financial's VentureXpert database was used to search all investments placed in these VEICs from November 6, 2004 though

[212] VEICs are industry specific codes which define areas of VC investments.

November 5, 2005.[213] The investments were analyzed to determine the VC fund that made the investment. Each VC fund that made an investment was then cross-referenced to identify the fund size, the number of investments the fund made, the average size of the investments and the percent of the fund which has been invested. Once these data were gathered, they were then analyzed to determine the trends in these VEICs with respect to fund size and investment size (Table 4).

After analyzing the data, many new points can be addressed. The first point relates to the average fund size for funds which have invested in the industries researched. It was previously noted that the average VC fund size for 2004 was $155.4 million.[214] When looking at the more high technology focused funds that the Navy would be interested in, the average fund size increased significantly to $371.78 million (Figure 16). It should come as no surprise that high technology requires larger investments and the data supports this assumption. Across five of the six sectors analyzed, the average fund size was greater than $155.4 million. As such, if the Navy were to start a VC fund at the proposed level, the fund would be capitalized at a significantly lower level than competing funds.

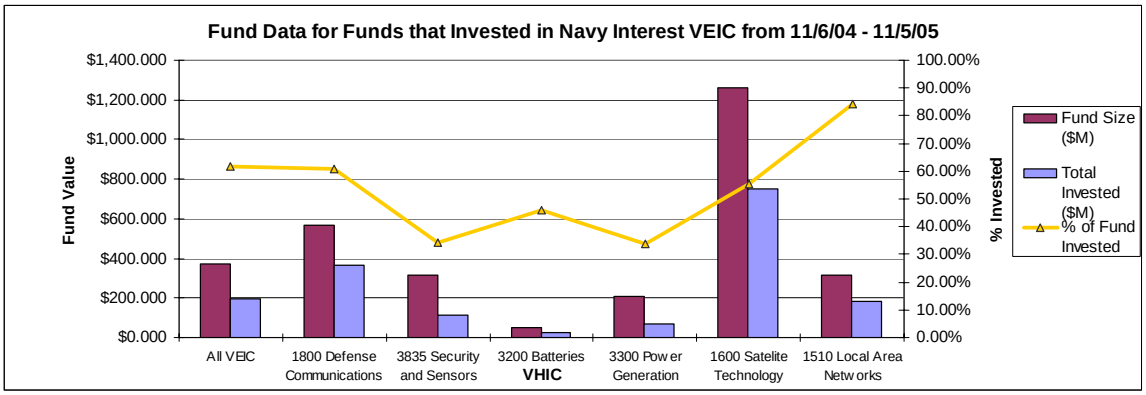

Figure 16. Fund Data for Funds that Invested in Navy Interest VEICs

When considering fund size, it is also important to consider what percentage of a fund is invested. Here again, data show that the average fund matching the Navy's interests only invests 62% of its value. The reasoning behind this is most likely that a

213 VentureXpert. Thomson Financial. 6 Nov. 2005 <http://vx.thomsonib.com>.

214 National Venture Capital Association Yearbook. New York: Thomson Venture Economics Information, 2005.

fund needs to keep money in reserve for additional financing rounds. A fund also needs to provide money for operation and management fees which can run 7% to 18% of a fund's value over its life.[215] Both of these "costs" would be present in any fund the Navy might raise.

Related to fund size, is the average investment that a VC fund makes relative to the industry invested in. Here, the data show that a typical VC fund's investment is a very small portion of its value. In five of the six industry sectors analyzed, the typical VC fund investment was less than 1% of the fund's value (Figure 17). The only industry analyzed which had an average investment greater than 1% of fund value was the Satellite Technology VEIC. In this VEIC, it is assumed that large investments are required based on the industry's focus, but no definitive conclusion could be reached through the data provided by Thomson Financial.

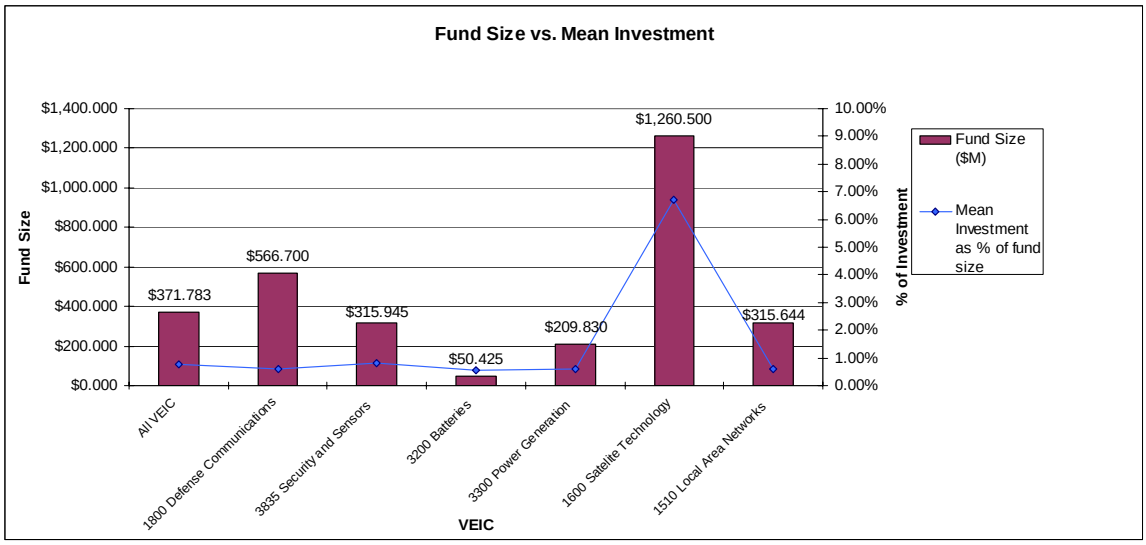

Figure 17. Fund Size vs. Mean Investment

This suggests that if a fund is small, the number of investments made seem to be small, as is the size of the investments. If the Navy were to have a VC fund valued at less than $60 million, then it would most likely need to make investments disproportionately smaller then the competing funds if it were to make the same number

[215] Kate Litvak. "Venture Capital Limited Partnership Agreements: Understanding Compensation Arrangements." Columbia Law School and Economics Working Paper No. 254 (2004). 29 Oct. 2005 <http://law.utexas.edu/law>.

of investments. While the data show that it is possible to make smaller investments, the smaller investments would most likely limit the Navy's visibility to the technology because the Navy would be a minor investor. Discussions with venture capitalists show that while these small investments are common, they are done with the intent of expected financial returns, not technology visibility. If the Navy fund were to make investments comparable to competing funds, then the fund would need to make significantly fewer investments, thereby limiting the technology it would have access to.

To put this aggregate data in perspective to the Navy's potential resources, assume that the Navy was to start a fund with a $60 million value.[216] Small funds lack the economies of scale present in larger funds so the management fees would be a significant portion of the Navy fund's value. It is reasonable to assume that over the life of the fund, management fees would amount to 15% of the funds value. This would equate to management fees of $9 million over the life of the fund. This would leave approximately $51 million available for investments. If the fund managers make 70% of this balance available for initial investments, that would equate to $35.7 million. If the average investment the fund makes is around $2.5 million, that would equate to the fund making approximately 14 investments over its life with the initial funding provided. As a basis for comparison, Figure 18 below shows that average number of companies that funds invest in for funds that have placed investments in the specific VEICs analyzed. If some of the investments could be spun off in a profitable manner, then the fund would be able to make additional investments.

[216]A $60 million dollar fund would mean that $20 million would be transferred for three years. This would be the most optimistic scenario based on the draft appropriation presented in Appendix A.

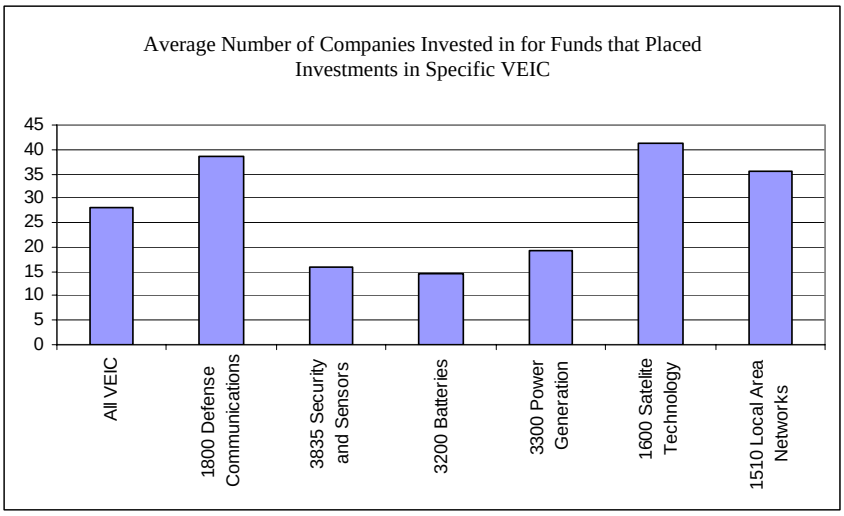

Figure 18. Number of Companies that Targeted Funds Invested In

B. ARMY VENTURE CAPITAL FUND AND RELATED INVESTMENTS

The data presented up to this point suggest that it would not be in the Navy's best interest to raise a Navy specific VC fund. A logical follow-on question would be, considering these data, how do the other government funds operate? In that the Navy draft legislation is similar to the Army's legislation, OnPoint would seem to be a good point of comparison.

According to Thomson Financial's VentureXpert database, OnPoint's fund is valued at $48 million and has placed seven investments since its inception in 2003.[217] The fund size is very close to the average VC fund invested in the Battery Technology VEIC ($50.4 million), one of OnPoint's technology focuses. In addition to the Battery Technology VEIC (3200), Thomson Financial's VentureXpert also shows that OnPoint has placed investments in the Power Supply VEICs (3300 series) and Semiconductor / Other VEIC (6599). [218] For funds that invest in the 3300 VEICs, the average fund size is

[217] VentureXpert. Thomson Financial. 6 Nov. 2005 <http://vx.thomsonib.com>.

[218] OnPoint data from Thomson Financial's VentureXpert were last updated on 13 Jul 2005. Based on interviews conducted with OnPoint Managing Director Jason Rottenberg, OnPoint is known to have made eight investments. Data for this section are based on the seven investments shown on Thomson's VentureXpert and do not include the investment made into PowerPrecise Solutions Inc.

close to $210 million. While this is larger than the OnPoint fund, it is still significantly lower than other funds that meet the Navy's interests.

Even though OnPoint is a small fund, it makes relatively large investments. According to Thomson Financial's VentureXpert, OnPoint's investments have an average size of $3.508 million.[219] This equates to an average investment of 7.3% of the funds value. This is well above the average across the sectors analyzed, but is in keeping with the investment size required in the technology interest areas (Table 3). Analysis suggests that OnPoint seems to be choosing to make fewer investments, but the investments it is making seem to be large enough to give OnPoint significant influence in the invested in company. If the Navy's goal with VC is technology identification, it would most likely need a similar strategy.

Average Per Deal Data for Investments made from 11/6/04 - 11/5/05				
Fund Investment	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
All VEIC	2.8539	6.91	0.03	44
1800 Defense Communications	3.41	3.879	0.07	7.5
3835 Security and Sensors	2.55	4.243	0.07	17.5
3200 Batteries	0.27	0.3815	0.03	0.71
3300 Power Generation	1.23	1.177	0.1	4.07
1600 Satellite Technology	84.53	249.55	0.2	750
1510 Local Area Networks	1.85	1.6294	0.03	6.53

Table 3. Average Per Deal Data

When looking at these industries and the investments OnPoint made, one can see that OnPoint invests in industries that attract smaller funds (relative to the industries the Navy is interested in). The corollary to this is that OnPoint is a highly focused fund. Because the Army mandated OnPoint focus on a specific need, OnPoint can thereby focus all of its resources in a few specific and related technologies. This simplifies the research OnPoint must do and allows them to become experts in the industries. This expertise may give OnPoint the ability to make better, more profitable (in terms of financial and technological returns) investments.

[219] VentureXpert. Thomson Financial. 6 Nov. 2005 <http://vx.thomsonib.com>.

Our research has not indicated similar circumstances with the Navy. The Navy's information needs (with respect to VC technology) seem to be too broad considering the resources that would be allocated. If the Navy were to identify a specific technology focus, like the Army has done with OnPoint, then a Navy VC fund would stand a higher probability of success.

	Industry Information								Fund Information				
Fund Name	No. of Deals	No. of Comp	No. of Firm	Avg Per Deal (USD Mil)	Avg Per Comp (USD Mil)	Avg Per Firm (USD Mil)	Sum Inv. (USD Mil)	Pct of Inv	Fund Size ($m)	Number of Companies	Avg Per Comp ($m)	Total Invested	% of fund size
1800 / 3810 Defense Communications and Military Electronics													
1810 Pequot Private Equity Fund III, LP	1	1	1	7.50	7.50	7.50	7.50	65.82	730.10	39	8.83	344.20	47.14%
1810 Corning Innovation Ventures	2	1	1	1.85	3.70	3.70	3.70	32.45	120.00	16	4.05	64.90	54.08%
1810 Battery Ventures VI, L.P.	3	1	1	0.07	0.20	0.20	0.20	1.73	850.00	61	11.30	692.30	81.45%
3810 Walnut Investment Partners, L.P.	1	1	1	1.35	1.35	1.35	1.35	30.00	105.00	12	5.50	65.30	62.19%
3835 Security and Sensors													
3835 Great Hill Equity Partners II, L.P.	1	1	1	44.00	44.00	44.00	44.00	35.49	460.00	8	15.57	124.56	27.08%
3835 Clarity Partners I	1	1	1	17.50	17.50	17.50	17.50	14.12	814.40	6	57.73	346.38	42.53%
3835 LLR Equity Partners II, L.P.	1	1	1	10.00	10.00	10.00	10.00	8.07	360.00	5	9.97	49.85	13.85%
3835 Harbert Venture Partners LLC	1	1	1	3.14	3.14	3.14	3.14	2.53	51.70	7	2.27	15.89	30.74%
3835 IDG Ventures Atlantic II, L.P.	1	1	1	3.00	3.00	3.00	3.00	2.42	180.00	1	3.00	3	1.67%
3835 Oak Investment Partners IX	1	1	1	2.90	2.90	2.90	2.90	2.34	1,000.00	56	13.61	762.16	76.22%
3835 Novak Biddle Venture Partners III, L.P	1	1	1	1.67	1.67	1.67	1.67	1.34	121.00	19	3.56	67.64	55.90%
3835 General Catalyst Group II, L.P.	1	1	1	1.67	1.67	1.67	1.67	1.34	211.10	12	4.52	54.24	25.69%
3835 Greylock XI, L.P.	1	1	1	1.67	1.67	1.67	1.67	1.34	1,000.00	38	5.10	193.8	19.38%
3835 IDG Ventures Atlantic I	1	1	1	1.67	1.67	1.67	1.67	1.34	100.00	9	2.85	25.65	25.65%
3835 Labrador Ventures IV, L.P.	2	1	1	0.45	0.90	0.90	0.90	0.73	90.00	17	3.07	52.19	57.99%
3835 Battelle Ventures, L.P.	1	1	1	0.72	0.72	0.72	0.72	0.58	150.00	4	1.89	7.56	5.04%
3835 Draper Fisher Jurvetson Fund VII, LP	1	1	1	0.72	0.72	0.72	0.72	0.58	640.00	34	4.00	136	21.25%
3835 Draper Fisher Jurvetson ePlanet Ventures, L.P.	1	1	1	0.72	0.72	0.72	0.72	0.58	639.80	42	6.88	288.96	45.16%
3835 Compass Venture Partners II	2	1	1	0.32	0.65	0.65	0.65	0.52	9.50	2	2.07	4.14	43.58%
3835 Halo Fund II, The	1	1	1	0.63	0.63	0.63	0.63	0.51	7.60	6	0.21	1.278	16.82%
3835 Novak Biddle Venture Partners IV, L.P.	1	1	1	0.61	0.61	0.61	0.61	0.49	150.00	6	2.44	14.64	9.76%
3835 PA Early Stage Partners III, L.P.	1	1	1	0.61	0.61	0.61	0.61	0.49	86.00	9	1.40	12.6	14.65%
3835 Jupiter Partners II, L.P.	1	1	1	0.40	0.40	0.40	0.40	0.32	226.80	6	23.16	138.948	61.26%
3835 Oak IX Affiliates Fund-A, L.P.	1	1	1	0.07	0.07	0.07	0.07	0.06	21.00	28	0.69	19.18	91.33%
9180 Advanced Aircraft and Aerospace													
9180 Maryland Technology Transfer Fund 05	1	1	1	0.08	0.08	0.08	0.08	55.56	1.80	24	0.06	1.488	82.67%
9180 Carlyle Strategic Partners, L.P.	1	1	1	0.06	0.06	0.06	0.06	44.44	129.80	3	1.88	5.628	4.34%
8240 Robotics													
8240 Investcare Partners L.P.	1	1	1	5.43	5.43	5.43	5.43	44.83	65.00	14	2.67	37.422	57.57%
8240 Acacia Venture Partners II	1	1	1	1.25	1.25	1.25	1.25	10.33	120.20	15	4.66	69.84	58.10%
3200 Batteries													
3200 Air Products and Chemicals	1	1	1	1.55	1.55	1.55	1.55	4.76	45.80	6	2.98	17.88	39.04%
3200 KB Partners Venture Fund II, L.P.	2	1	1	0.71	1.42	1.42	1.42	4.37	78.00	15	3.12	46.83	60.04%
3200 TMT Ventures	1	1	1	0.07	0.07	0.07	0.07	0.21	45.90	15	1.39	20.85	45.42%
3200 STARTech Seed Fund II	1	1	1	0.03	0.03	0.03	0.03	0.10	32.00	22	0.56	12.342	38.57%
3300 Power Supplies													
3300 Sierra Ventures VII, L.P.	2	1	1	2.85	5.70	5.70	5.70	9.93	250.00	52	4.81	249.964	99.99%
3300 Venrock Associates IV, L.P.	1	1	1	4.07	4.07	4.07	4.07	7.09	550.00	29	4.00	116	21.09%
3300 Illinois Emerging Technologies Fund, LP	2	1	1	1.62	3.24	3.24	3.24	5.65	26.30	8	0.81	6.48	24.64%
3300 Mohr, Davidow Ventures VII	1	1	1	3.01	3.01	3.01	3.01	5.24	450.00	23	5.30	121.9	27.09%
3300 Sierra Ventures VIII, L.P.	2	1	1	1.14	2.28	2.28	2.28	3.97	500.00	31	3.79	117.335	23.47%
3300 Rho Ventures IV	1	1	1	1.83	1.83	1.83	1.83	3.19	436.00	22	4.94	108.68	24.93%
3300 CenterPoint Venture Fund III	1	1	1	1.34	1.34	1.34	1.34	2.33	272.00	23	4.30	98.831	36.33%
3300 NJTC Venture Fund	1	1	1	0.75	0.75	0.75	0.75	1.31	82.00	23	1.38	31.832	38.82%
3300 Small Business Technology Investment Fund (SBTIF)	1	1	1	0.75	0.75	0.75	0.75	1.31	37.50	5	0.31	1.525	4.07%
3300 P/S BI New Energy Solutions	1	1	1	0.42	0.42	0.42	0.42	0.73	47.10	9	1.34	12.078	25.64%
3300 Chrysalix Energy II U.S. Limited Partnership	1	1	1	0.30	0.30	0.30	0.30	0.52	40.00	2	0.30	0.6	1.50%
3300 Hook Partners V	1	1	1	0.26	0.26	0.26	0.26	0.45	26.30	16	1.61	25.608	98.13%
3300 Venrock Entrepreneurs Fund IV, L.P.	1	1	1	0.10	0.10	0.10	0.10	0.17	10.60	8	0.19	1.488	14.04%
1600 Satelite Technology													
1600 APAX Europe V	1	1	1	750.00	750.00	750.00	750.00	81.22	4,133.00	78	30.80	2402.4	58.13%
1600 Polaris Venture Partners IV, L.P.	1	1	1	3.40	3.40	3.40	3.40	0.37	914.60	48	6.52	313.104	34.23%
1600 Morgenthaler Partners VI, L.P.	1	1	1	2.50	2.50	2.50	2.50	0.27	570.00	39	11.03	430.17	75.47%
1600 Novak Biddle Venture Partners III, L.P	1	1	1	1.44	1.44	1.44	1.44	0.16	121.00	19	3.56	67.64	55.90%
1600 Warburg Pincus Equity Partners, L.P.	1	1	1	1.25	1.25	1.25	1.25	0.14	5,000.00	143	23.57	3370.51	67.41%
1600 AIG Highstar Capital, L.P.	1	1	1	1.23	1.23	1.23	1.23	0.13	406.80	3	11.44	34.314	8.44%
1600 Novak Biddle Partners II, L.P.	1	1	1	0.50	0.50	0.50	0.50	0.05	60.00	16	2.77	44.32	73.87%
1600 Industrial Technology Ventures, LP (ITV)	1	1	1	0.30	0.30	0.30	0.30	0.03	49.10	10	3.29	32.9	67.01%
1600 Labrador Ventures IV, L.P.	1	1	1	0.20	0.20	0.20	0.20	0.02	90.00	17	3.07	52.139	57.93%
1510 Local Area Networks													
1510 Accel VIII L.P.	3	2	1	4.33	6.49	12.98	12.98	6.52	814.60	33	9.77	322.245	39.56%
1510 Sevin Rosen Fund VIII, L.P.	2	2	1	5.11	5.11	10.22	10.22	5.13	600.00	58	4.96	287.854	47.98%
1510 Oak Investment Partners X, L.P.	3	2	1	2.24	3.36	6.73	6.73	3.38	1,600.00	42	20.37	855.456	53.47%
1510 Highland Capital Partners VI	1	1	1	6.53	6.53	6.53	6.53	3.28	252.50	34	9.10	309.4	122.53%
1510 Benchmark Capital IV	1	1	1	6.25	6.25	6.25	6.25	3.14	1,000.00	48	9.58	459.888	45.99%
1510 Grotech Partners VI, LP	2	1	1	2.98	5.97	5.97	5.97	2.99	410.00	18	12.00	216	52.68%
1510 M/C Venture Partners V, L.P.	1	1	1	4.95	4.95	4.95	4.95	2.49	550.00	22	14.84	326.414	59.35%
1510 Oak Investment Partners IX	2	1	1	2.32	4.65	4.65	4.65	2.33	1,000.00	56	13.60	761.6	76.16%
1510 Menlo Ventures IX, L.P.	2	1	1	2.00	4.01	4.01	4.01	2.01	1,200.00	61	9.94	606.157	50.51%
1510 Alta California Partners II, L.P.	3	1	1	1.31	3.92	3.92	3.92	1.97	227.20	33	3.82	125.895	55.41%
1510 BCE Capital, Inc.	1	1	1	3.69	3.69	3.69	3.69	1.85	93.90	7	2.96	20.741	22.09%
1510 Kodiak Venture Partners I, L.P.	1	1	1	3.69	3.69	3.69	3.69	1.85	70.00	12	3.47	41.64	59.49%
1510 Kodiak Venture Partners II, L.P.	1	1	1	3.69	3.69	3.69	3.69	1.85	290.40	36	5.18	186.48	64.21%
1510 Castile Ventures II, L.P.	2	1	1	1.84	3.69	3.69	3.69	1.85	50.00	8	3.85	30.824	61.65%
1510 Redpoint Ventures II, L.P.	2	1	1	1.84	3.69	3.69	3.69	1.85	750.00	38	8.27	314.336	41.91%
1510 Alta California Partners III, L.P.	1	1	1	3.50	3.50	3.50	3.50	1.76	228.90	27	4.54	122.58	53.55%
1510 OVP Venture Partners VI, L.P.	1	1	1	3.40	3.40	3.40	3.40	1.71	185.70	18	3.08	55.494	29.88%
1510 Walden Ventures	2	1	1	1.36	2.71	2.71	2.71	1.36	7.80	49	0.97	47.285	606.22%
1510 BlueStream Ventures, L.P.	1	1	1	2.63	2.63	2.63	2.63	1.32	280.00	21	8.63	181.293	64.75%
1510 St. Paul Venture Capital VI	1	1	1	1.92	1.92	1.92	1.92	0.96	675.00	102	5.27	537.744	79.67%
1510 ComVentures IV, L.P.	2	1	1	0.76	1.52	1.52	1.52	0.77	350.00	30	8.78	263.34	75.24%
1510 Granite Global Ventures	1	1	1	1.43	1.43	1.43	1.43	0.72	160.00	24	3.72	89.184	55.74%
1510 OMAP Investment Program (FKA: TI Wireless Fund)	1	1	1	1.43	1.43	1.43	1.43	0.72	100.00	6	3.16	18.942	18.94%
1510 Oak IX Affiliates Fund, L.P.	1	1	1	1.43	1.43	1.43	1.43	0.72	9.30	28	0.68	18.928	203.53%
1510 Boulder Ventures IV	2	1	1	0.69	1.37	1.37	1.37	0.69	142.00	12	4.47	53.676	37.80%
1510 BrainHeart Capital	1	1	1	1.36	1.36	1.36	1.36	0.68	223.30	17	2.09	35.547	15.92%
1510 Clearstone Venture Partners II(FKA:idealab Cap. Partners II)	1	1	1	1.36	1.36	1.36	1.36	0.68	364.00	39	7.17	279.747	76.85%
1510 Evercore Ventures	1	1	1	1.36	1.36	1.36	1.36	0.68	100.00	12	1.39	16.632	16.63%
1510 Monitor Venture Partners, L.P.	1	1	1	1.36	1.36	1.36	1.36	0.68	10.30	2	1.03	2.066	20.06%
1510 Oak X Affiliates Fund, LP	3	2	1	0.42	0.63	1.26	1.26	0.63	22.50	33	1.30	42.9	190.67%
1510 Venrock Associates II, L.P.	1	1	1	1.20	1.20	1.20	1.20	0.60	272.00	73	3.44	251.12	92.32%
1510 JumpStartUp Venture Fund I LLC	1	1	1	1.20	1.20	1.20	1.20	0.60	40.00	15	2.13	31.95	79.88%
1510 MB Venture Capital Fund I	1	1	1	1.20	1.20	1.20	1.20	0.60	104.30	13	3.79	49.27	47.24%
1510 DAG Ventures, L.P.	1	1	1	1.17	1.17	1.17	1.17	0.59	60.30	2	1.52	3.048	5.05%
1510 Communications Fund	1	1	1	0.93	0.93	0.93	0.93	0.46	370.00	45	4.62	207.99	56.21%
1510 Venrock Associates III, L.P.	1	1	1	0.92	0.92	0.92	0.92	0.46	656.90	54	5.65	305.1	46.45%
1510 Venrock Associates	1	1	1	0.84	0.84	0.84	0.84	0.42	150.00	315	1.77	557.55	371.70%
1510 Ascent Venture Partners III, L.P.	2	1	1	0.34	0.69	0.69	0.69	0.35	116.00	27	3.10	83.7	72.16%
1510 Pitango Venture Capital Fund IV, L.P.	1	1	1	0.65	0.65	0.65	0.65	0.33	300.00	9	1.13	10.143	3.38%
1510 Trellis Partners II, L.P.	1	1	1	0.50	0.50	0.50	0.50	0.25	49.00	14	2.31	32.284	65.89%
1510 Trellis Partners L.P.	1	1	1	0.25	0.25	0.25	0.25	0.13	17.00	7	2.51	17.535	103.15%
1510 EDB Ventures Pte Ltd.	1	1	1	0.23	0.23	0.23	0.23	0.11	35.80	13	3.60	46.774	130.65%
1510 Lightspeed Venture Partners VI, LP	1	1	1	0.23	0.23	0.23	0.23	0.11	800.00	40	6.21	248.2	31.03%
1510 Ironside Ventures, L.P.	2	1	1	0.08	0.17	0.17	0.17	0.08	25.40	22	2.68	58.85	231.69%
1510 HLM CB	1	1	1	0.15	0.15	0.15	0.15	0.08	36.40	19	1.44	27.36	75.16%
1510 Oak IX Affiliates Fund-A, L.P.	1	1	1	0.07	0.07	0.07	0.07	0.03	21.00	28	0.69	19.18	91.33%
1510 Venrock Entrepreneurs Fund III, L.P.	1	1	1	0.03	0.03	0.03	0.03	0.01	13.80	44	0.21	9.196	66.64%

Table 4. VEIC Specific Data

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