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**NAVAL
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MONTEREY, CALIFORNIA

THESIS

**A COST-BENEFIT ANALYSIS OF EARLY
GRADUATE EDUCATION PROGRAMS FOR U.S.
NAVAL ACADEMY GRADUATES**

by

Christopher G. Milner

December 2003

Thesis Advisors:

Stephen L. Mehay
Linda D. Mallory

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**A COST-BENEFIT ANALYSIS OF EARLY GRADUATE EDUCATION
PROGRAMS FOR U.S. NAVAL ACADEMY GRADUATES**

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Lieutenant, United States Navy
B.S., Central Missouri State University, 1993

Submitted in partial fulfillment of the
requirements for the degree of

**MASTER OF SCIENCE IN
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from the

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ABSTRACT

This thesis examined the effects of participation in early graduate education programs on retention among 1988-1996 USNA graduates. The comparison group of non-participants consisted of USNA graduates in the top 200 on the Order of Merit in order to make the academic background similar to participants. The retention behavior of program participants and non-participants was compared to determine if granting early graduate education had an effect on retention to six years of service (one year beyond the minimum required service). For a pooled sample of all graduates, both the Voluntary Graduate Education Program (VGEP) and Scholarship program had positive effects on retention. The cost-benefit analysis found positive net benefits for VGEP, but a net-loss for the Scholarship program. However, while the analysis includes all costs, it omits some of the non-quantifiable benefits of the programs. If these benefits were quantified and included, it is expected that both programs would yield positive net benefits. Minor changes to the additional service requirements for both programs were recommended.

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I. INTRODUCTION

Graduate education opportunities are important in the modern military because they are absolutely vital to American interests. A fully developed, highly educated officer corps is the backbone of a well-equipped and trained military force that can respond to crises around the globe. The rapid evolution of technology and politics, as well as military intervention into new mission areas where significant national interests are involved, requires those who will be directly involved be well-rounded and ready to respond to a myriad of previously civilian and diplomatic situations. In a military operation there is often little time to call in an expert for problem solving. The person on the scene must deal with it.

The U.S. Navy typically offers funded graduate education to career-oriented officers after a fleet tour lasting about three to four years. This serves the dual purpose of rewarding the officer for a job well done and preparing him/her for greater responsibilities during follow-on tours. In many cases the funded education provides a sub-specialty code, which is required for the officer to be able to serve in specific jobs requiring extensive education or experience. Officers who undertake a funded graduate program will do so when they complete a fleet tour, when normally they will be a Lieutenant (pay grade O-3). They receive specialty pays and bonuses commensurate with their rank and community. They are also likely to be married (possibly with children), which further increases costs in the form of housing allowances and moving costs, as compared to single officers.

A. VGEP/SCHOLARSHIP

Though not a primary method of providing graduate education, there is a method for giving career-minded officers graduate education at a point earlier in their careers. This involves sending newly-commissioned officers back to school directly after commissioning. This provides the fleet with a graduate-educated officer at a more junior level, and allows the benefits of graduate education to be felt earlier in the officer's career. Also, these junior officers are less likely to be married and to be drawing such specialty pays as flight pay, resulting in less-expensive transfer and allowance costs.

Also, the immediate start of graduate studies often fills time that is otherwise wasted awaiting service school start dates after Naval Academy graduation.

Since the military recognizes the value of graduate education as a performance enhancer, a promotion tool, and a retention tool, it is important to determine whether Navy policies ensure maximum utilization of graduate education dollars. A very narrow portion of officer graduate education is facilitated through the U.S. Naval Academy. Newly commissioned officers from the U.S. Naval Academy (USNA) can attend graduate school prior to their fleet tours through two separate programs, the Voluntary Graduate Education Program (VGEP) and the civilian scholarship graduate education program (to be listed throughout as Scholarship). Both programs are highly selective and accept only a few of the roughly 1000 USNA graduates every year.

VGEP starts during the student's last year at the USNA. If the first-class midshipman's undergraduate academic and military schedule permits, graduate courses are taken at a local university, such as the University of Maryland. This gives the student a head start on graduate studies, more effectively filling the last year at USNA for those whose academic abilities allow more rapid completion of the rigorous undergraduate academic program. VGEP is largely composed of non-technical majors, owing to the shorter duration of the program.

After graduation from USNA, students complete civilian graduate studies at the Navy's expense with a cap of \$10,000 in direct education costs. For most, the graduation date is the December following USNA graduation, a period of about seven months. The \$10,000 cap currently covers the student's education expenses at the University of Maryland.

The Scholarship program takes place after graduation from USNA. Newly commissioned ensigns are allowed to accept civilian scholarships to graduate school. The government covers only pay and allowances. Students are not eligible for tuition assistance (TA) and must pay for any direct education costs that exceed the value of their scholarship.

Several prestigious graduate schools maintain a close working relationship with USNA in an attempt to lure highly qualified students to their institutions. Due to the quality of graduates and continuing success of the program, scholarships are often arranged through USNA connections. In short, the government reaps the benefit of the member earning a Master's degree from a prestigious university for only the cost of pay and benefits. In both programs, participants rejoin their warfare area training tracks after completing a Master's degree.

Both of these programs require the selectee to agree to an additional service commitment in return for the graduate education. This commitment is governed by various instructions, depending on the officer's community and program. However, the service commitment for VGEP and Scholarship runs concurrently with the officer's USNA graduation minimum service requirement (MSR), which is generally five years from USNA graduation for all non-aviation officers. Thus, the shorter graduate education service requirement is often completed prior to the USNA graduation service requirement. At the conclusion of the five-year commissioned service (YCS) point, the officer can decide to leave the military, or stay Navy and continue to serve.

At one extreme, a nuclear-trained submarine officer can complete a USNA undergraduate degree at a cost of around \$250,000, and attend graduate school through the Scholarship program. This would be followed by well over a year of Navy nuclear power training and submarine school. This education and training sequence would take the officer so close to the MSR that the only required fleet service would be the military mandated "minimum activity tour" of two years. In this example, the Navy could have paid well over \$500,000 dollars for education, training, and salary costs of an officer who would only spend two years in the fleet, which results in over \$250,000 dollars invested per year of fleet service (not including salary and benefits for those two years of service).

B. RESEARCH QUESTIONS

This thesis seeks to determine if there are any significant negative retention effects from granting graduate education too early in a career. With concurrent service requirements negating any of the required service extensions normally incurred for funded graduate education, it is possible that granting graduate education too early in an

officer's career may reduce retention by enhancing that officer's employability. In order to evaluate the effectiveness of the VGEP/Scholarship programs and determine their financial costs and benefits, this thesis will analyze the two programs for the USNA graduating classes of 1988-1996. Specifically, the thesis attempted to answer the following questions:

1. Do VGEP/Scholarship graduates leave the naval service at a higher rate than their peers?

2. Do the current VGEP and Scholarship programs represent an efficient use of resources?

It is hoped that this study will be of use to Navy officer personnel planners as well as the U.S. Naval Academy Graduate Education Committee and Program Manager in assessing the overall benefits and costs of continuing the VGEP and Scholarship programs. Additionally, specific recommendations are made for program improvement.

C. DATA AND ANALYSIS

Data for program participants and USNA graduating classes 1988-1996 was obtained through the USNA Office of Institutional Research Data Warehouse, which maintains a database on all aspects of USNA students and alumni. The data source for post-USNA events (retention) is the Navy Officer Master File. Statistical analysis of the data was conducted in an effort to test the research questions. Based on the research questions posed, a number of multiple regression models were estimated. Only officers for whom complete data could be obtained were analyzed.

D. LIMITATIONS

There were certain limitations to this study. This study consisted of USNA graduates 1988-1996 of all warfare specialties, except aviation. However, the thesis focused on Navy Unrestricted Line (URL) warfare communities. Due to the extended service requirements of the aviation field, the retention definition used for surface, SEAL, submarine, and other officers was determined not to be useful for aviators. Naval Aviators and Naval Flight Officers incurred longer minimum service requirements (MSR) due to the extensive, and costly, training pipeline. Though the aviation

community was the original impetus for the creation of the VGEP program in 1983, they were omitted from the analysis in this thesis. The justification for omitting aviators relies on the assumption that the longer required service period for aviators ensures a positive return on the investment in graduate education.

Aside from warfare-community limitations, there are definite differences in the application and selection processes for the USNA and NROTC commissioning sources. Because officers from both commissioning sources are subject to the exact same conditions in the fleet, it is assumed that the results of this study will have some applicability to NROTC graduates.

One confound noted during the time period of the study was the post-Cold War military force reductions, which also coincided with a rapidly expanding civilian job market. These two factors resulted in a large exodus of officers. Since officers in whom the Navy invested in graduate education would be of sufficient quality that they would not be intentionally forced out of the service, force reductions should not have had an influence on retention of graduate educated officers. Also, any effects from downsizing can be controlled in the regression models. Also, the planned low retention (downsizing) during the time period of this study would allow a conservative analysis in determining if the military's best and most-educated were leaving the service to pursue civilian employment. With the Navy doing little to encourage retention during this time, it can be assumed that the more marketable officers would be more susceptible to outside influences and be more likely to leave the service in search of civilian employment.

Chapter III describes the statistical approach used to answer the research questions posed in Chapter I. The results of the retention analysis are presented in Chapter IV. These retention results are used to estimate cost savings to the government in Chapter V. The retention findings and resultant cost-savings are summarized in Chapter VI.

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II. LITERATURE REVIEW

This chapter is intended to describe the current level of knowledge concerning graduate education in the military context. The major theme of this chapter revolves around a comprehensive review of published literature pertaining to military education, and specifically about the VGEP and Scholarship programs. Information is contained in this chapter in an attempt to contextualize the retention results to be found later and the resultant cost comparisons.

A. EDUCATION VERSUS TRAINING

The commonly accepted definition of training is instruction that teaches a skill, sequence or action such as cleaning or operating a weapon. Basically, training prepares one for an expected situation or action. Education, on the other hand, teaches a thought process, improving the ability to respond to broader and unforeseen situations. Education is more general in nature (Sarkesian, Williams, & Bryant, 1995, pp. 17, 65). Since foreign relations and policy are complex and ever changing, it does little good to impart an officer with a checklist of “if this, then that.” The officer must be able to recognize, understand and respond to changing environments in a responsible fashion while keeping mission and any constraints in mind.

B. HISTORY OF MILITARY EDUCATION

While officers need extensive training, education is more often seen as the key to promotion and responsibility. This is not a new concept, it has long been expected that a military officer be well educated in various fields. From the earliest days of the United States Navy, periods of inaction were strictly devoted to professional development and various missions were devised to test the abilities of officers to respond to the challenges of their office (McKee, 1991):

It is by no means enough that an officer of the Navy should be a capable mariner. He must be that, of course, but also a great deal more. He should be as well a gentleman of liberal education, refined manners, punctiliously courtesy, and the nicest sense of personal honor. -John Paul Jones, 18th Century American Naval Hero (U.S. Naval Academy, 2002a, p. 2).

We still continue perfectly idle so far as it relates to public service... We employ most of our time in reading and in endeavoring to acquire useful

general and professional knowledge. LT Charles Morris, USN, 1808 (personal letter from LT Morris to Noadiah Morris; quoted in McKee, 1991, p. 214).

The nation that will insist on drawing a broad line of demarcation between the fighting man and the thinking man is liable to find its fighting done by fools and its thinking done by cowards. -19th Century British General Sir William Francis Butler (Bahnsen & Cone, 1990, p. 28).

World War I showed the inadequacies of military preparations in training and officer development. Social selection of officers and antiquated aristocratic privileges crippled the efficiency and morale of western militaries (Ropp, 1987, p. 47). During the war, ill-prepared officers were consumed at such a rate that it was often difficult to fully man front-line units. Casualties were so severe in the British Army that second lieutenants often commanded battalions after battles. This was great for junior officer promotion, however, due to inadequacies in pre-war British officer development, there were few qualified officers to promote.

The German officers did better in the field due to strict Prussian militaristic traditions prevalent in pre-war Germany that stressed and trained war fighting to an extreme (Demeter, 1935; Allard, 2000). Prussian General von Moltke repeatedly subjected the Prussian General Staff to realistic and demanding mobilization planning problems in an effort to round out the Prussian officer corps to prevent problems which could be exceptionally dangerous on the battlefield (Holley; taken from Allard 2000; Simons & Higham, 2000). As is now known, the Germans fell on their faces, not on the battlefield, but behind it, where General von Moltke had worked so hard to avert tragedy. The utter and complete lack of awareness of logistics, supply, and support cost the Germans dearly in Belgium during the first month of the war and nagged them ever after (Converse, 1998). The Germans could fight exceptionally well if they could get to the front with all of their equipment and adequate supplies. A lopsided officer corps was not as effective on the field as they were on the training grounds where problems are often solved with assumptions, calculations, and rules (Simons, 2000, p. 136).

After World War I, and with the advent of the technology boom of the 20th-Century, it became as important to master technology and equipment as the “art” of command and warfare. Morris Janowitz, a noted American military sociologist states, “Perhaps it would be more accurate to conclude that European military professionals fought to maintain their social position by monopolizing officership until their numbers ran out, and until they were displaced by the ever-increasing need for technical experts” (Janowitz, 1960, np). The huge casualty rates of “old-school” officers and lessons learned in the first largely modern (by today’s standards), highly mechanized war served to start the transformation of European military powers.

Accordingly, training and schooling became more centralized and formalized. The social selection of officers stopped for the most part in Western powers. Officers were largely selected based on merit or professional qualifications, such as graduation from a military academy or officer training course. Active officers were starting to be formally schooled upon their indoctrination to be somewhat skilled in their profession before being sent to front line units. This greatly improved their overall competency, though the reserve officers who would fill wartime ranks were often not as proficient or qualified (Converse, 1998). Unfortunately, the United States military retained the antiquated, seniority-based promotion system until World War II, limiting the influence of new blood within the officer corps. The U.S. military seniority-based promotion system was changed during World War II and officially modified into the modern version in 1947 (Janowitz, 1960, p. 62).

Officers generally acquitted themselves well on all sides during the World War II, having taken the dear lessons of World War I to heart. This is not to say that nothing was learned. World War II was a technology revolution of its own. The first atomic weapons were used, the first jet aircraft, the first cruise missile, the first ballistic missile, and the first guided missiles, among other innovations. Technology allowed man to kill each other in ways never before dreamed of, though the overall war was largely decided in the old-fashioned way with large armies in the field and fleets at sea.

After the war, Allied military officials were confronted with a whole new range of problems created by the total destruction of enemy homelands. Social, political, and

economic problems were the order of the day. Janowitz noted in that the increased technology and complexity of military operations increased the importance of the “military manager” (Janowitz, 1960, p. 22). Officers were

...coping with problems of supply, and industrial mobilization, administering occupied territories. Many military professionals came to realize that... subjects such as economics, comparative government, international relations, and foreign languages should be regarded as staples rather than frills in a program of military education (Lovell, 1979, np).

These sentiments were echoed 40 years later, “The unique nature of many of these [military operations other than war]... may require adjustments not only in military doctrine, but also in the military’s combat-oriented warrior mentality” (Franke, 1999, p. 2). Evolving technology and tactics had an affect on the expected operations, “Joint commanders in future operations will... be expected to focus the technologies and practices of operations security, deception, electronic warfare, and even psychological operations through tightly integrated campaign plans” (JCS, 1994; quoted in Allard, 2000, np). This was more or less Allied confirmation of the German lessons of World War I.

After World War II as the education level of Americans in general rose, the military turned to university-level education to solve some of these problems. Officers were recruited from many fields other than military science. Additional specialized training was also seen as desirable. As early as 1973, the Office of the Secretary of Defense was attempting to get the benefits of widespread graduate education into the American Officer Corps. The Assistant Secretary of Defense also noted that the U.S. military was not fully utilizing the skills of graduate degrees that officers already held (Office of Assistant. Secretary of Defense, Manpower & Reserve Affairs, 1973).

C. MODERN TRENDS

The lessons of the first half of the 20th Century clearly demonstrated the need for military professionals in areas other than actual combat. Military professionals, or at least a visible portion of them, need to be skilled in fields beyond tactics and strategy. Fields such as economics, manpower, transportation, medicine, business and many others may

be required in the course of military duty. These other requirements had the effect of civilianizing the military.

However, was bringing in specialties other than actual combat a threat to the ‘warrior spirit’ within our military? Janowitz (1960) believed not, citing the example of World War II when numerous warriors and other professions coexisted so harmoniously and effectively that the services all maintained their own semi-autonomous research centers after the war. He stated that it was “...possible for one man to embody both roles, and World War II did produce a number of officers of this variety” (Janowitz, 1960, p. 36).

As a counterpoint, Moskos and Wood introduced the “institutional/occupational” thesis in 1977 which discusses whether the military was and should have been more institutional, espousing high values and esprit de corps, or should have been more occupational as were many European militaries where unionization and self-interests largely affect the military populations (Moskos & Wood, 1988, p. 3). “The occupational model implies the priority of self-interest rather than that of the employing organization.” Moskos and Wood have identified certain traits among Air Force officers who saw themselves as “specialists” (rather than officers), thus subscribed to the occupational model. Among those traits was decreased loyalty to the organization, lower retention and increased dissatisfaction with real or perceived differences between their positions and comparable civilians (Moskos & Wood, 1988, pp. 32-34).

Not only has our view of officer education been molded by past events, but even future events promise to be demanding on the professional development of officers. Chairman of the Joint Chiefs of Staff, General Shalikashvili, noted in 1995, “The security challenges of a largely bipolar world have been replaced with more ambiguous and, in some cases, equally dangerous problems” (Franke, 1999, p. 1). The military is increasingly involved in operations other than destroying an enemy on the battlefield. Secretary of Defense Perry said in a 1996 address, “...you face the challenges of being a warrior, a statesman, a technological innovator, a manager, a coalition builder and a leader... (Franke, 1999, p. 13). Janowitz mirrored these sentiments (Janowitz, 1960, p. 34, 70).

The modern military is involved in numerous operations, many of them new, untried missions that are aimed at preventing wars or restoring a fractured peace. “Between 1988 and 1996, seventeen new [United Nations] peacekeeping operations were conducted... That is more than the number of UN operations in the preceding four decades” (Dandeker & Gow, 1997, p. 327). But, is a military largely trained to face the Soviet Red Army in Western Europe suited for these missions? Many modern thinkers and policy makers have doubts that a solely battle-trained force will make effective peace-keepers for they often lack the skills required to prevent the battle they are trained to fight (Meeker & Segal, 1987; Segal & Segal, 1993; Miller & Moskos, 1995; Sarkesian, Williams, & Bryant, 1995; Franke, 1997).

As noted by Secretary of Defense Cheney,

[Military officers] represent the human capital that will sustain the global leadership of the United States and secure its role as the world’s sole remaining superpower into the twenty-first century. The demands placed on these officers, and the myriad of challenges they will confront, have rarely been higher (Center for Strategic and International Studies [CSIS], 1997, p. ix).

With the dawning of the 21st Century, broad based Professional Military Education (PME) and graduate education are firmly established in our military. There are increasing numbers of ways to obtain a graduate degree for today’s officer and the need for that graduate degree is clear.

Today, a young [Army] Captain standing at a road juncture between formerly warring parties in Bosnia is equal parts soldier, diplomat, negotiator, provider of humanitarian relief, and law enforcer. In the future, he will have to deal with such things as information warfare and cyber crime. Better equipping him to fulfill each of those roles and responsibilities will be a key challenge facing the PME [Professional Military Education] system. (CSIS, 1997, np).

D. GRADUATE EDUCATION

If the US military values fresh ideas and innovation, advanced education is one avenue to pursue it. The education is of considerable value in and of itself, but the

process by which a graduate degree program challenges the individual spark the ideas of innovation. Often, military degree seekers work the actual problems confronting their organizations. Naval Postgraduate School and Naval Academy faculty and graduate students have written thousands of graduate research theses and dissertations testing various hypotheses and scenarios on every topic from retention to combat effectiveness. The Naval War College fought the “Imperial Japanese Navy” 127 times in war games prior to the attack at Pearl Harbor. Their detailed games resulted in the 1934 recommendation to the Chief of Naval Operations to “plan for a four-year conflict that would involve the progressive seizures of island bases in the Marshalls, Carolinas, and/or Mariannas (CSIS, 1997, p. 14). Fleet Admiral Chester Nimitz remarked of their efforts, “The [war college] courses were so thorough that, after the start of World War II, nothing that happened in the Pacific was strange or unexpected except the kamikazes” (quoted in CSIS, 1997, p. 14).

Without this professionally encouraged personal academic and mental challenge, the military would not lean towards innovation: “Whether the problem is missiles or manpower, planning toward the future tends to be a projection of existing trends, rather than an imaginative emphasis on revolutionary developments” (Janowitz, 1960, p. 28).

Going back to the institutional/occupational argument, William Clover and Thomas McCloy of the US Air Force Academy staff have noted decreasing institutional values the longer a student remained at the Academy. This is possibly due to the individualistic nature of the rigorous academic curriculum (Moskos & Wood, 1988, p. 9). It stands to reason that placing students into an additional challenging academic environment would only reinforce the individual achievement. Remembering that individualism over unit is the tenet of the occupational model, would occupational values be increasing at the expense of institutional values if graduate education were widely offered?

The added value of a graduate degree has been seen in Navy officer promotion and screening patterns for quite some time (Steiner, 1986; Talaga, 1994; Fuchs, 1996; Philips, 2001; Bowman & Mehay, 1998 & 2002). But what about the civilian sector? Would it not be reasonable to expect that a graduate degree would be beneficial to

corporate America also? With the booming economy of the 1990s and rising civilian salaries it could be surmised that well-educated officers likely have promising career opportunities in the outside world. With emphasis on higher education, is the Navy supplying corporate America with not only great leaders, but highly educated ones as well? Evidence overwhelmingly points to a “no” on this question. Officers with graduate degrees tend to stay in service longer than non-graduate educated officers (Steiner, 1986; Bowman & Mehay 1998, 2002). DuMont (1997) postulated, based on exit data, that postgraduate education could actually serve as a retention enhancement tool within the Surface Warfare Officer community. Bowman & Mehay (2002) showed that graduate education serves as an extremely cost-effective retention tool. Oddly, offering graduate education, an individual challenge and reward, increases institutional loyalty in the form of performance, promotion and retention.

Another potentially significant benefit of investing in civilian graduate education, versus military graduate programs like Naval Postgraduate School and various command and staff colleges, is the impact on the military-civilian gap. Wars of self-defense like World War II are generally popularly supported since the need for military action is clear and significant national security and defense implications are at stake.

As military interventions move more towards operations-other-than-war, public support often wanes because of ill-defined political objectives, especially if American casualties start mounting. Having military exposure to large numbers of future civilian leaders, as in the graduate school environment, puts a face on the uniform. Large scale civilian exposure to the military’s best and brightest presents the military as qualified, motivated, human and above all, American. For a civilian graduate student with no other personal military connection, being able to relate in a positive manner to a classmate who happens to be a Naval officer may prove central to their opinion of the military. These are the educated members of our society who largely influence American public opinion.

This idea was successfully tested in mid-1800s Italy sparking interest in France by the 1870s. The idea was shelved for a generation due to lack of interest. When finally implemented, the originally intended benefits of military-civilian cross education were

lost to inept planning and overemphasis on full military honors and tradition (Ropp, 1987, p. 125).

According to research, the need for graduate education for military officers is clear. What is less clear is the research to substantiate the specific attributes of officers which are provided solely by graduate education and not related to other factors. Basically, at this time, it has been proven that graduate education is needed, but it has not been proven that the emphasis on graduate education actually solves the operational problems for which it is sought (Talaga, 1994). Sarkesian (1995) noted the lack of research on the effects of military graduate education makes literature review and summarizing the current status of knowledge on the subject difficult.

E. ECONOMIC FACTORS

The time period of 1993-2003 is crucial. Not only is this the window of opportunity for USNA graduates within the research time period to leave the service, but also it corresponds with very low unemployment rates in the civilian sector. It is entirely possible that this demand for skilled labor in the civilian world pulled officers out of the military in search of higher paying, less demanding civilian jobs. If true, this would tend to make this study more conservative since it is assumed that highly educated officers with high USNA class rankings would be in top demand whatever the job market, but even more so in the hiring frenzy of the mid to late 1990s.

F. REGRESSION ANALYSIS ASSUMPTIONS

Sample data was analyzed in a series of binary logistic regressions. There are four main assumptions that are required for regression analysis. They are as follows:

1. The response y can be represented by the probabilistic model:

$$y = \beta_0 + \beta_1 x + \varepsilon$$

2. x is measured without error.
3. ε is a random variable such that, for a given value of x ,

$$E(\varepsilon) = 0 \text{ and } \sigma^2_{\varepsilon} = \sigma^2$$

and all pairs $\varepsilon_i, \varepsilon_j$ are independent in a probabilistic sense.

4. For a given value of x , ε possesses a normal probability distribution (Mendenhall, Beaver, & Beaver, 2001, p. 502).

III. DATA ANALYSIS

The literature review conducted above focused on military graduate education, the history behind it and the need for it. Converse (1997) is the most comprehensive study of the military education requirements facing the modern military. Others, including Janowitz (1960), Moskos & Wood (1988), Segal (1993), and Sarkesian (1995), all support the theory of a well-rounded, highly educated corps of officers leading well-educated troops.

Moskos & Wood (1988), Segal (1993), and Converse (1998) all felt in the modern era of limited, or low-intensity warfare, to achieve limited political goals, military leaders' intellectual and management abilities would be more important to individual officers in the field. Whereas previous eras of total warfare centered on the absolute destruction of the enemy force and/or homeland, modern warfare is often waged with the specific goal of preserving the opposing force's infrastructure, economic assets and resources. In short, the military needs to be able to do more than simply fight. Modern peacekeeping operations require patience, understanding, and education in order to meet the needs of the parties involved instead of merely responding to the violence displayed.

One secondary benefit of graduate education is the increased institutional loyalty shown by recipients of military funded programs. Focusing largely on the Navy, a number of retention and promotion studies conclude that graduate education enhances selection to higher positions and promotion opportunities for Navy officers at various points in their careers (Jordan (1991), Talaga (1994), Fuchs (1996), Bowman & Mehay (1999; 2002) Phillips (2001)). Also, the studies show that Navy recipients tend to stay in service longer, perhaps feeling that the institution values their service as shown by the Navy's willingness to fund education costs. Documented comparisons also exist in the Army (Sarkesian, Williams, & Bryant, 1995).

What has not been adequately explored within the Navy is whether or not the graduate degree actually meets the requirement for which it exists (beyond, of course, keeping highly qualified and motivated officers in the service). There is limited research

on the subject of whether graduate education actually produces any noticeable changes in job performance or habits. It is difficult to determine what changes in individual officers result from the graduate education experience, and what are characteristics inherent in the top performers the military sends to graduate school. Some performance changes can be seen immediately after the experience, but both time and distance and lack of immersion within the specialty tend to attenuate performance effects. One result of graduate education cited by officers was their ability to understand the “big picture” and their roles and responsibilities within the military (Sarkesian, Williams, & Bryant, 1995).

What has not been studied extensively is the effect of offering of graduate education early in the career prior to fleet or field service. Naval Academy graduate education opportunities in the form of VGEP and Scholarships were examined by Bowman (2000), who determined that 1983-1989 recipients of VGEP were less likely than their peers to remain in service to the O-4 (LCDR) board. In Bowman’s study, participants in both early graduate education programs have higher separation rates than the comparison group. Jordan (1991) found a similar result where graduate education in general had a negative impact on retention prior to the LCDR screening (at approximately 9.5 YCS).

A. CONTENT EXPERTS

The Scholarship program operates Navy-wide and as such there are several Scholarship content experts within the Navy. However, USNA receives the vast majority of Scholarship quotas. Moreover, VGEP is a Naval Academy-only program. At USNA, the VGEP and Scholarship programs are administered for the Academic Dean and Provost, Dr. William C. Miller, through the Graduate Education Committee (GEC). The Graduate Education Program Manager is Ms. Marjorie Roxburgh (USNA, 2002c). Ms. Roxburgh has 40 years of USNA experience including 20 years as the Graduate Education Program Manager.

B. DATA COLLECTION AND SAMPLE

The major goal of this study is to analyze the retention experience of USNA alumni who participated in early graduate education programs. Both fleet data and USNA historical data were needed for this analysis. The length of active service of each USNA

graduate was obtained from the Defense Manpower Data Center (DMDC) through the USNA Office of Institutional Research (OIR). Naval Academy graduate information was obtained from the historical records maintained in the Institutional Research Data Warehouse. The records of VGEP and Scholarship participants were supplied by the USNA Graduate Education Program Manager and compared against the independently collected Bowman (2000) data set.

It is this study's contention that the USNA graduate whose final graduation Order of Merit (OOM) places him at the bottom of the class should not be included in the comparison group of those selected for immediate graduate education. They share a common graduation date and possibly even a common Naval Academy experience, but those at the top of the class are much different from those who barely graduate. More important, those with a high OOM (low class rank) do not qualify for immediate selection to graduate education programs.

It was decided that due to the relatively small number of program participants in a given year, a time period spanning multiple years would be used to increase the size of the sample. The years 1988 through 1996 were chosen because this contains a sufficient number of graduates and program participants and all have passed the six-year retention window. The research time period was also selected to be as recent as data collection would allow, therefore improving generalization of the results to the current population. The retention of program participants was compared to the retention behavior of selected comparison groups (results presented in Chapter 4). In addition to the statistical analysis, a cost-benefit analysis of the two graduate programs is performed (with results presented in Chapter V).

Due to the large number of USNA graduates over the nine-year period (N=9004), any data that must be deleted should not affect results so long as it does not pertain to a VGEP or Scholarship recipient (N=312). Reasonable efforts were made to identify and correct all missing or miscoded data. Dropping observations due to incomplete data was presumed to have a negligible impact on overall results.

This study focused specifically on USNA graduates so all midshipmen within the Brigade who failed to graduate for any reason were eliminated from the sample. There were 99 late graduates who had an OOM of zero, making OOM comparisons invalid for them. As graduates, they were retained in the data set but were placed in the lowest category for peer rankings (Top 1000). One Scholarship recipient was categorized as a late graduate.

All USNA graduates who service selected Marine Corps were dropped due to the belief that USMC culture is sufficiently different from that of the Navy and retention factors would differ from those of Navy officers. This resulted in elimination of 1259 officers, including 20 program participants (11 VGEP/9 Scholarship). A total of 132 international students and inter-service transfer students were dropped from the data set, none of whom were program participants. Additionally, 18 USNA graduates who were not commissioned were also dropped.

After dropping observations for the above reasons, the sample included 8854 graduates, all of whom were commissioned into the Navy. There were 292 program participants in the population divided into 112 VGEP and 180 Scholarship recipients.

All aviation selectees (pilots and naval flight officers) were eliminated due to the extended MSR associated with aviation service. Aviation selectees' minimum service requirements extend well beyond the six-year research window making all retention comparisons invalid for them. This resulted in a loss of 2805 members, including 87 program participants (40 VGEP/47 Scholarship). Another 19 officers were eliminated due to incomplete data pertaining to community selection. Another four non-participants were eliminated because of incomplete data concerning USNA major (two others fitting this description had been previously eliminated with other elimination categories).

It is known that at least seven VGEP recipients failed to graduate with a Master's degree prior to USNA detachment at the end of their graduate education window (USNA, 1990, 1991, 1992, 1994). It is possible there was a similarly small percentage of Scholarship students who also failed to graduate before returning to duty at the end of their graduate education window. It was decided to retain those students as program

participants even though they did not receive a degree because they imposed costs on the Navy in the form of money and time away from fleet duty. They were not distinguished in any way in the data set or analyses.

It is also known that two members of the Class of 1990 started VGEP but were subsequently selected for the Scholarship program. They were defined as Scholarship program participants and dropped from the VGEP group since they incurred more government costs, both time and money, during their Scholarship program participation.

The final data set contained 4752 officers, including 72 VGEP and 133 Scholarship participants. This was the sample that was statistically analyzed.

C. VARIABLES

Data from the USNA-OIR and DMDC files was used to create several variables for analysis. The new variables are described in Table 1.

Table 1 Variable Description.

| | |
|-----------|---|
| IN@6YRS: | =1 if member on active duty 6 yrs after USNA graduation, =0 if not on active duty |
| MINORITY: | =1 if non-Caucasian, =0 if Caucasian |
| FEMALE: | =1 if female, =0 if male |
| VGEP: | =1 if VGEP participant, =0 if not a VGEP participant |
| SCHOLAR: | =1 if a Scholarship participant, =0 if not a Scholarship participant |
| ATHLETE: | =1 if member was USNA varsity letter winner, =0 if not a varsity letter winner |
| OOM100: | =1 if in top 100 of USNA OOM, =2 if in top 200, =3 if in top 300, =4 if in top 400, =5 if in top 500. |
| SWO: | =1 if conventional Surface Warfare Officer, =0 if not SWO |
| NSWO: | =1 if Surface Warfare Officer (Nuclear), =0 if not NSWO |
| NSUB: | =1 if Submarine Warfare Officer (Nuclear), =0 if not NSUB |
| SPEC: | =1 if SEAL or Special Operations Officer, =0 if not SPEC |
| OCOMM*: | =1 if other community (General Unrestricted Line and all Restricted Line Officers), =0 if not OCOMM |
| GROUP1: | =1 if USNA Group 1 Major (engineering), =0 if not GROUP1 |
| GROUP2: | =1 if USNA Group 2 Major (sciences), =0 if not GROUP2 |
| GROUP3: | =1 if USNA Group 3 Major (humanities), =0 if not GROUP3 |
| YR88: | =1 if member of USNA Class of 1988, =0 if not |
| YR89: | =1 if member of USNA Class of 1989, =0 if not |
| YR90: | =1 if member of USNA Class of 1990, =0 if not |
| YR91: | =1 if member of USNA Class of 1991, =0 if not |
| YR92: | =1 if member of USNA Class of 1992, =0 if not |
| YR93: | =1 if member of USNA Class of 1993, =0 if not |

YR94: =1 if member of USNA Class of 1994, =0 if not
 YR95: =1 if member of USNA Class of 1995, =0 if not
 YR96: =1 if member of USNA Class of 1996, =0 if not

*Note: The OCOMM variable contains all officers not contained in other warfare variables. Communities include General Unrestricted Line (28), Medical (75), Oceanography (9), Supply (16), Civil Engineer (29), Intelligence (16), and Cryptology (8).

D. DATA ANALYSIS

To determine the comparison group for graduate education participants, the selection OOM were analyzed to determine the OOM of selectees and non-selectees. A clear breakpoint was found in selection OOM. This breakpoint was used to identify the members of the comparison group.

The main research question: “Do VGEP/Scholarship recipients leave the service at a higher rate than their peers?” required estimation of a binary logistic model. Significance was set at 95% using a one-tail criterion of significance. For the pooled sample, containing all officers in all communities, this model was estimated using IN@6YRS as the dependent variable. Independent variables were: VGEP, SCHOLAR, FEMALE, MINORITY, ATHLETE, GROUP2, GROUP3, NSWO, NSUB, SPEC, OCOMM, YR88, YR89, YR90, YR92, YR93, YR94, YR95, and YR96.¹

Thus, the logit model specification was as follows:

$$\text{IN@6YRS} = \alpha_0 + \beta_0\text{VGEP} + \beta_1\text{SCHOLAR} + \beta_2\text{FEMALE} + \beta_3\text{MINORITY} + \beta_4\text{ATHLETE} + \beta_5\text{GROUP2} + \beta_6\text{GROUP3} + \beta_7\text{NSWO} + \beta_8\text{NSUB} + \beta_9\text{SPEC} + \beta_{10}\text{OCOMM} + \beta_{11}\text{YR88} + \beta_{12}\text{YR89} + \beta_{13}\text{YR90} + \beta_{14}\text{YR92} + \beta_{15}\text{YR93} + \beta_{16}\text{YR94} + \beta_{17}\text{YR95} + \beta_{18}\text{YR96}.$$

To determine if results would be affected by an officer’s community affiliation, the community dummy variables were removed and the data sample was split into community groupings as explained above. A similar binary logit regression model was estimated that omitted the dummy variables for community:

¹ SWO was specifically excluded making it the reference community. Likewise, 1991, the first year not significantly affected by the post-Cold War drawdown, was excluded, making it the graduation year reference point.

$$\text{IN@6YRS} = \alpha_0 + \beta_0 \text{VGEP} + \beta_1 \text{SCHOLAR} + \beta_2 \text{FEMALE}^2 + \beta_3 \text{MINORITY} + \beta_4 \text{ATHLETE} + \beta_5 \text{GROUP2} + \beta_6 \text{GROUP3} + \beta_{11} \text{YR88} + \beta_{12} \text{YR89} + \beta_{13} \text{YR90} + \beta_{14} \text{YR92} + \beta_{15} \text{YR93} + \beta_{16} \text{YR94} + \beta_{17} \text{YR95} + \beta_{18} \text{YR96}.$$

For all logit models, the marginal effect of each independent variable was calculated. Results were judged to be statistically significant if they met the 95% confidence threshold using a one-tail test.

E. COST-BENEFIT ANALYSIS

The costs of VGEP and Scholarship were determined. The resultant costs were compared to statistically determined retention behaviors for both program participants and the comparison group. The economic model was recreated from Bowman (2000).

F. PROGRAM COSTS TO THE GOVERNMENT

To determine the cost of the VGEP and Scholarship programs, ensign (O-1 <2yrs service) Base Pay was added to ensign housing and subsistence allowances (BAH and BAS) for the Annapolis, MD area (Zip Code 21402). Since VGEP students are still attached to USNA, this was the correct cost measure. However, Scholarship students often left Annapolis to attend graduate school and drew allowances based on their actual geographical location. Annapolis is a relatively high cost area to live and Annapolis BAH values are higher than in many other areas. By retaining the higher Annapolis BAH values in the Scholarship cost analysis, a conservative measure of costs was obtained and the need to determine the actual allowances for program recipients, which would vary widely from year to year as students accepted scholarships from institutions in different locations, was eliminated. Scholarship recipients incurred no government funded education costs. VGEP recipients were each limited to \$10,000 in government funding. Even though it is possible that many students did not use the full \$10,000 government VGEP subsidy, the full subsidy amount was used for each student to obtain bias the cost-benefit analysis against graduate education.

² FEMALE was eliminated from the submarine community analysis since women are restricted from submarine duty.

All base pays and allowances were calculated for participants during the remaining time up to the six-year window. These were added to the direct costs of by the graduate education.

Non-participant officer costs were calculated in a similar manner. Ensign, lieutenant (junior grade), and lieutenant base pay and allowances were calculated up to the six-year point to determine the cost of a six-year non-participant officer. It should be noted that many officers receive bonuses, specialty or proficiency pays, but these were deliberately omitted to derive a conservative cost estimate.

By definition, non-participant officer costs do not include the cost of graduate school. Officers returning from fleet service rarely receive full scholarships to graduate school and depend on some sort of government funding to complete a Master's degree. This can come in the form of tuition assistance (TA), graduate education voucher (GEV), or a fully-funded program such as Naval Postgraduate School (NPS). The Navy's GEV allows up to \$40,000 for completion of a Master's degree while USNA's LEAD program costs around \$20,000 per student. NPS resident education costs can exceed \$160,000 depending on program of study (Gates, Maruyama, Powers, Rosenthal, & Cooper, 1998, p. 14). None of the above cost figures includes the officers' pay and allowances. The costs to provide non-participants with a Master's degree, as well as any possible performance differences from lack of early graduate education, were specifically ignored during this study.

G. CUMULATIVE COSTS AT SIX YEARS OF SERVICE

Using the above costs, the total cost to the government will be estimated for an officer reaching six years of active duty in both programs as well as for a six-year lieutenant who has not received graduate education at government expense. Pay and allowances will be included for all officers from commissioning until the six-year point. Retention ratios for communities and/or programs, where statistical significance is achieved, will be combined with the associated costs at the six-year point to achieve an estimate of the total cost of each officer. The number of commissioned USNA ensigns required to achieve 1 six-year lieutenant will be determined for each program and/or

community. Estimated costs required to achieve 1 six-year lieutenant for early graduate education participants will be compared against the same costs for non-participants.

H. DEFINITION OF TERMS

The following definitions are offered to support research and clarify results:

Program participants is defined as those USNA graduates from 1988-1996 who participated in either VGEP or civilian Scholarship programs. Delayed graduate education opportunities such as the Burke Scholarship were not examined.

Retention: Program participants who remain on active military service until at least the six-year point after USNA graduation are defined as stayers. Due to varying USNA graduation dates, the retention date was set for all years at 1 June, six years after USNA graduation.

Peers: The comparison group for program participants. Retention outcomes will be compared for each group.

Order Of Merit (OOM): OOM is a measure used at USNA to rank graduates. It encompasses academic and military performance grades as well as conduct, physical education and athletic achievement (USNA, 1996a).

Voluntary Graduate Education Program (VGEP): VGEP is a USNA-only program where highly qualified First Class Midshipmen attend graduate school starting their last semester at USNA. After USNA graduation, they remain assigned to USNA and are expected to complete a Master's degree by December of the same year (USNA, 2001). Extensions are occasionally granted allowing the student until the following May to complete graduate studies. Costs to the government include up to \$10,000 in tuition and fees as well as pay and benefits.

Scholarship Program: The scholarship program is a Navy-wide program that allows graduating Midshipmen and NROTC candidates to accept civilian scholarships to graduate school. For those who are offered scholarships, and for whom the Navy allows their acceptance, the Navy allows the officer up to two years to complete a graduate degree. The only direct cost to the government is pay and benefits while the student attends graduate school. Education costs are covered by the scholarship and/or the student (CNO, 1998). USNA gets the vast majority of the Navy's authorized billets.

Minimum Service Requirement (MSR): Depending on community of service assigned, USNA graduates are obligated to at least five years of active duty. All members in the sample pool were obligated to a five year MSR.

I. HYPOTHESES

For this study several hypotheses will be tested. Based on the increased marketability of officers with graduate degrees, it is assumed that there will be some sort of loss associated with offering graduate education programs. The null hypothesis would be that program participants leave the Navy at the same rate as non-participants. The alternate hypothesis would be that program participants stay in service at a different rate than their peers.

H_0 = Graduate education recipients do not attrite at a differing level than their peers.

H_A = Graduate education recipients exit the Navy at a different rate than their peers.

J. ASSUMPTIONS

In order to conduct this study, several assumptions had to be made. USNA graduation Order Of Merit (OOM) is more than a class rank. It is assumed to be a demonstration of personality, motivation, work ethic, emotional and intellectual intelligence. The actual mathematical calculation to determine OOM changes over time but it is assumed that those who graduate near the top of the class are systematically different from those near the bottom. Regardless of the formula, OOM is assumed to be a reliable measure of relative quality of USNA graduates. Thus, the USNA graduate who is 15th in the graduating class is not an academic or educational peer of the 915th graduate.

It is assumed that the logit model includes all reasonable variables that affect officer retention and that the effect of VGEP or Scholarship selection can be reliably isolated as a retention factor.

It is assumed that USNA graduates with low OOM (near the top of their class) will have better civilian employment opportunities than their classmates at the bottom of the class. Therefore, graduates with low OOM will constitute a superior comparison group for program participants.

IV. DATA ANALYSIS

This chapter presents the results of the retention analysis. Demographic factors were included in the regression model to determine if any of these demographic factors affected a member's retention decision. Table 2 provides frequencies of background characteristics of USNA graduating classes by sex for the 1988-1996 period. Table 3 displays frequencies of program participants and the total number of USNA graduates by year.

Table 2 Frequencies of USNA Graduates by GENDER.

| | Males | Females | Total |
|-----------------------------|--------------|----------------|--------------|
| Graduates | 8144 | 860 | 9004 |
| Program Participants | 299 | 13 | 312 |
| Group 1 Major | 3177 | 188 | 3365 |
| Group 2 Major | 2267 | 301 | 2568 |
| Group 3 Major | 2694 | 371 | 3065 |
| Unknown Major | 6 | 0 | 6 |
| Non-Caucasian | 1316 | 158 | 1474 |
| Varsity Athletes | 2172 | 460 | 2632 |

Table 3 Program Participants by YEAR.

| YEAR | VGEP | Scholarship | USNA Grads |
|--------------|-------------|--------------------|-------------------|
| 1988 | 10 | 8 | 1060 |
| 1989 | 10 | 14 | 1082 |
| 1990 | 9 | 10 | 1008 |
| 1991 | 7 | 8 | 955 |
| 1992 | 6 | 18 | 1031 |
| 1993 | 5 | 19 | 1066 |
| 1994 | 8 | 18 | 940 |
| 1995 | 12 | 18 | 916 |
| 1996 | 5 | 20 | 946 |
| Total | 72 | 133 | 9004 |

A. THE COMPARISON GROUP

Table 4 shows the distribution of program participants by OOM. Descriptives for program participants in Table 5 show that the overwhelming majority of selectees were ranked in the top 200 OOM. Fully 65 of 72 VGEP participants (90.3%) and 127 of 133 Scholarship participants (95.5%) were ranked in the top 200 OOM. The overall percentage of participants ranked in the top 200 OOM was 93.7%. Thus, all USNA

graduates who ranked in the top 200 OOM were identified as the comparison group for the program participants. Program participants' retention at the six-year point will be compared to graduates ranked on the OOM ≤ 200 . The total number of officers meeting this condition was 1012, including the 65 VGEP and 127 Scholarship recipients. Frequencies of demographic characteristics of the program participants are shown in Table 5 and of the comparison group in Table 6.

Table 4 Distribution of Program Participants by OOM.

| USNA Ranking | VGEP # (cumulative %) | Scholarship # (cumulative %) | Total Recipients (cumulative %) |
|---------------------|----------------------------------|---|--|
| Top 100 OOM | 50 (69.4%) | 115 (86.5%) | 165 (80.5%) |
| Top 200 OOM | 65 (90.3%) | 127 (96.2%) | 192 (93.7%) |
| Top 300 OOM | 70 (97.2%) | 130 (97.7%) | 200 (97.6%) |
| Top 400 OOM | 71 (98.6%) | 131 (98.5%) | 202 (98.5%) |
| Total | 72 | 133 | 205 |

Table 5 Frequencies of Characteristics of Program Participants.

| Descriptor | VGEP (N=72) | Scholarship (N=133) | Total (N=205) |
|------------------------|--------------------|----------------------------|----------------------|
| Males | 68 | 125 | 193 |
| Females | 4 | 8 | 12 |
| Non-Caucasian | 4 | 15 | 19 |
| Varsity Athlete | 16 | 41 | 57 |
| Group 1 Major | 19 | 93 | 112 |
| Group 2 Major | 20 | 26 | 46 |
| Group 3 Major | 33 | 14 | 47 |
| SWO | 15 | 15 | 30 |
| Nuclear SWO | 8 | 12 | 20 |
| Nuclear SUB | 39 | 92 | 131 |
| SEAL/Spec Ops | 3 | 6 | 9 |
| Other Community | 6 | 8 | 15 |

Table 6 Frequencies of Characteristics of Comparison Group.

| Descriptor | Total (N=808) |
|------------------------|----------------------|
| Males | 712 |
| Females | 96 |
| Non-Caucasian | 53 |
| Varsity Athlete | 282 |
| Group 1 Major | 378 |
| Group 2 Major | 259 |
| Group 3 Major | 171 |
| SWO | 165 |
| Nuclear SWO | 72 |
| Nuclear SUB | 329 |
| SEAL/Spec Ops | 76 |
| Other Community | 166 |

B. REGRESSION ANALYSIS RESULTS

Statistics from the regression models are presented in this chapter under the appropriate section heading. The complete results of the individual logit models are contained in APPENDIX A. Of the 1013 officers analyzed, 670 remained on active duty six years after USNA graduation, a retention rate of 66.14%. The retention experience for program participants was 54 stayers of 65 VGEP participants, and 109 stayers of 127 Scholarship participants, for retention rates of 83.08% and 85.83%, respectively. Retention rates are shown in Table 7.

Table 7 Sample Retention Rates

| Group | Stayers | Retention Rate |
|-------------------------|----------------|-----------------------|
| Comparison Group | 507 of 808 | 62.75% |
| VGEP | 54 of 65 | 83.08% |
| Scholarship | 109 of 127 | 85.83% |
| Pooled Sample | 670 of 1013 | 66.14% |

C. REGRESSION RESULTS: POOLED SAMPLE

Table 8 displays the results of the retention model for the pooled sample, containing all 1013 officers in all communities. The table presents the mean value of each independent variable and the estimated coefficients and associated significance levels. Finally, the last column displays the calculated marginal effects of each variable.

Table 8 Pooled Sample Retention Model.

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|---------------------------------|--------|-------------|--------------|-----------------|
| Grad Ed: | | | | |
| VGEP | 0.06 | 1.203 | 0.001 | 0.262 |
| SCHOLARSHIP | 0.13 | 1.195 | 0.000 | 0.261 |
| Demographics: | | | | |
| FEMALE | 0.11 | 0.261 | 0.301 | 0.057 |
| MINORITY | 0.07 | 0.344 | 0.233 | 0.075 |
| ATHLETE | 0.26 | 0.012 | 0.945 | 0.003 |
| Other (GROUP 1 omitted): | | | | |
| GROUP2 | 0.300 | -0.220 | 0.193 | -0.048 |
| GROUP3 | 0.220 | -0.251 | 0.194 | -0.055 |
| Community (SWO omitted): | | | | |
| NSUB | 0.45 | 0.150 | 0.469 | 0.033 |
| NSWO | 0.09 | -0.816 | 0.003 | -0.178 |
| SPEC | 0.08 | 0.150 | 0.608 | 0.033 |
| OCOMM | 0.18 | -0.435 | 0.064 | -0.095 |
| Year (1991 omitted): | | | | |
| YR88 | 0.1115 | -0.651 | 0.034 | -0.142 |
| YR89 | 0.1451 | -0.811 | 0.005 | -0.177 |
| YR90 | 0.1254 | -0.639 | 0.032 | -0.139 |
| YR92 | 0.1007 | -0.195 | 0.547 | -0.042 |
| YR93 | 0.1046 | -0.806 | 0.010 | -0.176 |
| YR94 | 0.1066 | -0.759 | 0.015 | -0.165 |
| YR95 | 0.1115 | -0.342 | 0.276 | -0.074 |
| YR96 | 0.0898 | 0.090 | 0.800 | 0.020 |
| Constant | 1 | 1.144 | 0.000 | 0.249 |

Note: statistically significant coefficients (at .05 or .10 level) in bold

For the pooled sample, compared to conventional SWOs, nuclear SWOs were 17.8% less likely to stay in the Navy for six years. Members of the Classes of 1988, 1989, 1990, 1993, and 1994 were more likely to leave the service before six years than the reference class (1991).

Both graduate education program logit coefficients were positive and significant in Table 8. The marginal effect indicates that VGEP participants were 26.2% more likely to remain in service, and that Scholarship participants were 26.1% more likely to remain

in service to the six year point. Program participation has an important, positive effect on officer retention.

D. REGRESSION RESULTS: SURFACE WARFARE OFFICERS (NON-NUCLEAR)

Of the 195 Surface Warfare Officers analyzed, 63 remained on active service six years after USNA graduation, including 13 of 14 VGEP and 12 of 15 Scholarship recipients. The initial model failed to converge due to the small sample of minorities. Thus, the MINORITY variable was eliminated and the model re-estimated. Table 9 shows the results of the SWO retention model.

Table 9 Surface Warfare Retention Model

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|---------------------------------|--------|---------------|--------------|-----------------|
| Grad Ed: | | | | |
| VGEP | 0.0718 | 1.991 | .000 | 0.408 |
| SCHOLARSHIP | 0.0769 | 0.698 | 0.323 | 0.143 |
| Demographics: | | | | |
| FEMALE | 0.0564 | -0.313 | 0.529 | -0.064 |
| MINORITY | N/A | N/A | N/A | N/A |
| ATHLETE | 0.28 | -0.219 | 0.566 | -0.045 |
| Other (GROUP 1 omitted): | | | | |
| GROUP2 | 0.270 | -0.088 | 0.841 | -0.018 |
| GROUP3 | 0.430 | -0.154 | 0.709 | -0.032 |
| Community (SWO omitted): | | | | |
| NSUB | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | |
| YR88 | 0.0564 | -0.795 | 0.411 | -0.163 |
| YR89 | 0.17 | -1.964 | 0.007 | -0.402 |
| YR90 | 0.0769 | -1.485 | 0.071 | -0.304 |
| YR92 | 0.12 | -0.799 | 0.319 | -0.164 |
| YR93 | 0.0769 | -1.642 | 0.047 | -0.336 |
| YR94 | 0.1 | -0.504 | 0.553 | -0.103 |
| YR95 | 0.12 | -0.189 | 0.822 | -0.039 |
| YR96 | 0.17 | -0.765 | 0.314 | -0.157 |
| Constant | 1 | 1.798 | 0.008 | 0.368 |

Note: statistically significant coefficients (at .05 or .10 level) in bold

For the conventional Surface Warfare Officers, the Classes of 1989 and 1993 were less likely (40.2 and 33.6%, respectively) to stay in the Navy for six years than the reference class (1991). The VGEP program logit is positive and significant. SWO VGEP participants are 40.8% more likely than SWO non-participants to remain in service until the six year point. The coefficient of the Scholarship program was not significant indicating there is no difference between Scholarship participants' retention and non-participants' retention.

E. REGRESSION RESULTS: SURFACE WARFARE OFFICERS (NUCLEAR)

Of the 92 Surface Warfare Officers (Nuclear) analyzed, 47 remained on active service six years after USNA graduation, including five of seven VGEP and nine of 11 Scholarship recipients. The originally proposed model failed to converge so the MINORITY and YR96 variables were eliminated and the regression rerun. Table 10 shows the results of the Surface Warfare (Nuclear) model estimation.

Table 10 Surface Warfare Officer (Nuclear) Retention Model

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|---------------------------------|--------|--------------|--------------|-----------------|
| Grad Ed: | | | | |
| VGEP | 0.0761 | 1.037 | 0.322 | 0.258 |
| SCHOLARSHIP | 0.12 | 1.845 | 0.050 | 0.459 |
| Demographics: | | | | |
| FEMALE | 0.087 | 0.199 | 0.845 | 0.050 |
| MINORITY | N/A | N/A | N/A | N/A |
| ATHLETE | 0.21 | -0.158 | 0.833 | -0.039 |
| Other (GROUP 1 omitted): | | | | |
| GROUP2 | 0.230 | 1.430 | 0.036 | 0.356 |
| GROUP3 | 0.210 | -0.117 | 0.855 | -0.029 |
| Community (SWO omitted): | | | | |
| NSUB | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A |

Surface Warfare Officer (Nuclear) Retention Model (Continued)

| Year (1991 omitted): | | | | |
|-----------------------------|--------|--------|-------|--------|
| YR88 | 0.18 | -1.938 | 0.178 | -0.482 |
| YR89 | 0 | N/A | N/A | 0.000 |
| YR90 | 0.1254 | -1.261 | 0.545 | -0.314 |
| YR92 | 0.13 | -0.760 | 0.766 | -0.189 |
| YR93 | 0.0978 | -1.992 | 0.366 | -0.495 |
| YR94 | 0.0978 | -1.344 | 0.953 | -0.334 |
| YR95 | 0.13 | 0.415 | 0.208 | 0.103 |
| YR96 | N/A | N/A | N/A | N/A |
| Constant | 1 | 0.436 | 0.431 | 0.108 |

Note: statistically significant coefficients (at .05 level) in bold

Within the Surface Warfare Officers (Nuclear), Group 2 majors were 35.6% more likely than Group 1 majors to remain on active duty for six years. The Scholarship coefficient was both positive and statistically significant. NSWOs participating in the Scholarship program were 45.9% more likely than NSWO non-participants to remain on active duty until the six-year point. The coefficient of VGEP was not significant, indicating there is no difference in retention between VGEP participants and non-participants.

F. REGRESSION RESULT: SUBMARINE WARFARE OFFICERS (NUCLEAR)

Of the 460 Submarine Warfare Officers (Nuclear) analyzed, 330 remained on active service six years after USNA graduation, including 32 of 35 VGEP and 79 of 87 Scholarship recipients. Table 11 depicts the results of the Submarine Warfare (Nuclear) model estimation.

Table 11 Submarine Warfare Officer (Nuclear) Retention Model

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|----------------------|-------------|--------------------|---------------|------------------------|
| Grad Ed: | | | | |
| VGEP | 0.0761 | 1.863 | 0.003 | 0.346 |
| SCHOLARSHIP | 0.19 | 1.647 | 0.000 | 0.306 |
| Demographics: | | | | |
| FEMALE | N/A | N/A | N/A | N/A |
| MINORITY | 0.0804 | -0.679 | 0.077* | -0.126 |
| ATHLETE | 0.22 | 0.030 | 0.915 | 0.006 |

Table 11 Submarine Warfare Officer (Nuclear) Retention Model (Continued)

| Other (GROUP 1 omitted): | | | | |
|---------------------------------|--------|---------------|---------------|---------------|
| GROUP2 | 0.260 | -0.408 | 0.113 | -0.076 |
| GROUP3 | 0.120 | -0.130 | 0.721 | -0.024 |
| Community (SWO omitted): | | | | |
| NSUB | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | |
| YR88 | 0.13 | -0.744 | 0.135 | -0.138 |
| YR89 | 0.17 | -1.007 | 0.032 | -0.187 |
| YR90 | 0.16 | -0.604 | 0.213 | -0.112 |
| YR92 | 0.0807 | 0.139 | 0.816 | 0.026 |
| YR93 | 0.1 | -0.853 | 0.105 | -0.158 |
| YR94 | 0.11 | -0.997 | 0.053* | -0.185 |
| YR95 | 0.0913 | -0.622 | 0.262 | -0.116 |
| YR96 | 0.0587 | 0.254 | 0.735 | 0.047 |
| Constant | 1 | 1.423 | 0.001 | 0.264 |

Note: statistically significant coefficients (at .05 or .10 level) in bold

The variable FEMALE was removed from the Submarine Warfare Officer (Nuclear) analysis because submarine duty is restricted to men only. The members of the Class of 1989 were more likely to leave the service by six years than the reference class (1991). The coefficient of Minority status and Class of 1994 were marginally significant and negative.

The coefficients for both the VGEP and Scholarship programs were positive and significant. VGEP participants were 34.6% more likely than non-participants to remain in service until 6 years and Scholarship participants were over 30% more likely to remain in service than non-participants. The effects of early graduate education on retention were strongest in the submarine community.

G. REGRESSION RESULTS: SPECWAR/SPECOPS OFFICERS

Of the 85 SEAL and Special Operations Officers analyzed, 59 remained on active service six years after USNA graduation, including two of three VGEP and four of six Scholarship recipients. The originally proposed model failed to converge so the

MINORITY, FEMALE and YR93 variables were eliminated and the logit model re-estimated. Table 12 shows the results of the SpecWar/SpecOps model estimation.

Table 12 Special Warfare Retention Model

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|---------------------------------|--------|--------------|--------------|-----------------|
| Grad Ed: | | | | |
| VGEP | 0.0353 | -1.093 | 0.518 | -0.218 |
| SCHOLARSHIP | 0.0706 | -0.597 | 0.550 | -0.119 |
| Demographics: | | | | |
| FEMALE | N/A | N/A | N/A | N/A |
| MINORITY | N/A | N/A | N/A | N/A |
| ATHLETE | 0.34 | 0.463 | 0.438 | 0.092 |
| Other (GROUP 1 omitted): | | | | |
| GROUP2 | 0.190 | -0.666 | 0.342 | -0.133 |
| GROUP3 | 0.290 | -0.245 | 0.690 | -0.049 |
| Community (SWO omitted): | | | | |
| NSUB | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | |
| YR88 | 0.0941 | -1.956 | 0.067 | -0.390 |
| YR89 | 0.0941 | -1.973 | 0.061 | -0.394 |
| YR90 | 0.0941 | -1.593 | 0.139 | -0.318 |
| YR92 | 0.12 | -1.531 | 0.133 | -0.305 |
| YR93 | N/A | N/A | N/A | N/A |
| YR94 | 0.15 | -1.686 | 0.086 | -0.336 |
| YR95 | 0.15 | -0.983 | 0.342 | -0.196 |
| YR96 | 0.11 | 0.162 | 0.909 | 0.032 |
| Constant | 1 | 2.175 | 0.011 | 0.434 |

Note: statistically significant coefficients (at .05 level) in bold

There were no statistically significant variables in the retention model for the SpecWar/SpecOps group. Early graduate education recipients' retention is not statistically different from their peers, but it should be kept in mind that the model was estimated using only 85 observations, so that the results may not be reliable.

H. ALL OTHER COMMUNITIES

Of 181 officers in various, often unrelated, communities grouped into the “OCOMM” variable, 102 remained on active duty six years after USNA graduation. Two of six VGEP and five of eight Scholarship recipients remained on active duty at six years. Table 13 shows the results of the Other Communities model estimation.

Table 13 Other Officer Community Retention Model

| VARIABLE | MEAN | Coefficient | SIG | MARGINAL EFFECT |
|---------------------------------|--------|-------------|-------|-----------------|
| Grad Ed: | | | | |
| VGEP | 0.0331 | -1.097 | 0.254 | -0.267 |
| SCHOLARSHIP | 0.0442 | 0.100 | 0.905 | 0.024 |
| Demographics: | | | | |
| FEMALE | 0.036 | -0.080 | 0.835 | -0.019 |
| MINORITY | 0.0829 | 0.600 | 0.349 | 0.146 |
| ATHLETE | 0.33 | 0.347 | 0.348 | 0.085 |
| Other (GROUP 1 omitted): | | | | |
| GROUP2 | 0.520 | -0.425 | 0.296 | -0.104 |
| GROUP3 | 0.210 | -0.562 | 0.259 | -0.137 |
| Community (SWO omitted): | | | | |
| NSUB | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | |
| YR88 | 0.1 | 0.634 | 0.378 | 0.154 |
| YR89 | 0.14 | 0.533 | 0.421 | 0.130 |
| YR90 | 0.11 | -0.470 | 0.478 | -0.115 |
| YR92 | 0.11 | -0.236 | 0.724 | -0.058 |
| YR93 | 0.15 | -0.949 | 0.125 | -0.231 |
| YR94 | 0.0718 | -0.679 | 0.379 | -0.165 |
| YR95 | 0.1 | -1.213 | 0.083 | -0.296 |
| YR96 | 0.0829 | 0.006 | 0.994 | 0.001 |
| Constant | 1 | 0.782 | 0.174 | 0.191 |

Note: statistically significant coefficients (at .05 level) in bold

There were no statistically significant results in the retention model for the Other Community group. Early graduate education participants in all “other communities” were not statistically different from non-participants in retention behavior. However, again, the small sample size for this model makes the results unreliable.

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V. COST ANALYSIS

A cost-benefits analysis is presented in this chapter to determine the average per-officer cost to the government for each program, as well as the overall costs for all participants. Program participants' cost-to-the-government will be compared to estimated costs for non-participating officers reaching the same 6 year point. Comparisons of these estimated costs will be used to determine the programs' cost efficiencies.

Junior Naval officers follow a fairly rigid promotion pattern until the lieutenant commander (LCDR/O-4) selection, which occurs around 10 years service. Normal promotion windows were used to calculate officer costs. Officers stay in the rank of ensign (ENS) and lieutenant (junior grade) (LTJG) for two years each. At the four-year point, they are promoted to lieutenant (LT) where they remain until their LCDR screen. Table 14 explains the pay and allowances used to determine the cost of an officer.

Table 14 Officer Cost Elements*

| | |
|---------------------------|---|
| ENS<2yrs Base Pay: | \$2183.70 |
| ENS BAH (w/o dep): | \$995.00 |
| BAS (for all officers): | \$167.20 |
| ENS Education Cost: | \$10,000 (VGEP only) |
| LTJG>2yrs Base Pay: | \$2864.70 |
| LTJG>3yrs Base Pay: | \$3299.40 |
| LTJG avg Base Pay: | \$3082.05 (averaged over the 2 years as a LTJG) |
| LTJG BAH (w/o dep): | \$1229.00 |
| LT>4yrs Base Pay: | \$3883.50 |
| LT BAH (w/ dep): | \$1781.00 |
| Officer bonuses/pro-pays: | Not included |

*All figures monthly except *ENS Education Cost* which is a one-time payment.
Source: DFAS/DTIC

Certain non-cash military benefits such as commissary, exchange and leisure privileges were ignored since the value of the benefits would have been similar for all service members. Although, the married lieutenant's family health care coverage may be worth more than a single ensign's coverage, this factor also was ignored.

A. NET COST PER VGEP OFFICER AT SIX YEARS

To determine overall VGEP cost to the government, base pay and allowances were added to education costs. Only pay after USNA graduation was included since the participant would have been receiving midshipman pay regardless of program participation and would not have seen fleet service during this time. Total base pay and allowances were calculated for this officer until the six-year point. The sum of education costs and pay and allowances was used as the government’s cost to produce a six-year lieutenant via the VGEP program. Since an officer is normally promoted to LTJG at the two-year point and remains until the four-year point at which time he/she is promoted to LT, the LTJG>2yrs service and LTJG>3yrs service base pay rates have been averaged to produce the LTJG avg Base Pay which is used in the cost calculations. Table 15 shows the cost breakdown of the VGEP program.

Table 15 VGEP Participant Cost Breakdown

| | | |
|---|--------------------------------|--------------------|
| | ENS Base Pay | \$2,183.70 |
| + | ENS BAH (w/o dep) | \$995.00 |
| + | ENS BAS | \$167.20 |
| = | Cost per month | \$3,345.90 |
| X | number of months | 6 |
| = | Total Pay & Allowances | \$20,075.40 |
| + | Gov’t Education Cost | \$10,000.00 |
| = | Net Program Cost | \$30,075.40 |
| | ENS Pay & Allowances | \$3345.90 |
| X | number of ENS months remaining | 18 |
| = | Remaining ENS Cost | \$60,226.20 |
| + | Net Program Cost | \$30,075.40 |
| = | Total ENS Cost | \$90,301.60 |

| | | |
|---|------------------------|---------------------|
| | LTJG avg Base Pay | \$3,082.05 |
| + | LTJG BAH (w/o dep) | \$1,229.00 |
| + | LTJG BAS | \$167.20 |
| = | Cost per month | \$4,478.25 |
| X | number of months | 24 |
| = | Total Pay & Allowances | \$107,478.00 |
| = | Total LTJG Cost | \$107,478.00 |
| | | |
| | LT Base Pay | \$3,883.50 |
| + | LT BAH (w/ dep) | \$1,781.00 |
| + | LT BAS | \$167.20 |
| = | Cost per month | \$5,831.70 |
| X | number of months | 24 |
| = | Total LT Cost | \$139,960.80 |

The government costs associated with each rank are added to estimate the total government cost of an officer over six years:

$$\$90,301.60 + \$107,478.00 + \$139,960.80 = \mathbf{\$337,740.40 \text{ per VGEP officer}}$$

B. NET COST PER SCHOLARSHIP OFFICER AT SIX YEARS

To determine the cost of the Scholarship program, a similar model was used. There were no direct education costs to the government since the scholarship and student cover all education costs. Table 16 shows a government cost breakdown of the Scholarship program. Participants normally remain in the Scholarship program for a full 24 months, the same duration as their time in the rank of ensign. Thus, the Scholarship costs and ENS costs are the same.

Table 16 Scholarship Cost Breakdown.

| | | |
|---|-----------------------------|--------------------|
| | ENS Base Pay | \$2,183.70 |
| + | ENS BAH (w/o dep) | \$995.00 |
| + | ENS BAS | \$167.20 |
| = | Cost per month | \$3,345.90 |
| X | number of months | 24 |
| = | Total Pay & Allowances | \$80,301.60 |
| + | Gov't Education Cost | \$0.00 |
| = | ENS/Net Program Cost | \$80,301.60 |

| | | |
|---|------------------------|---------------------|
| | LTJG avg Base Pay | \$3,082.05 |
| + | LTJG BAH (w/o dep) | \$1229.00 |
| + | LTJG BAS | \$167.20 |
| = | Cost per month | \$4,478.25 |
| X | number of months | 24 |
| = | Total Pay & Allowances | \$107,478.00 |
| = | Total LTJG Cost | \$107,478.00 |
| | | |
| | LT Base Pay | \$3883.50 |
| + | LT BAH (w/ dep) | \$1,781.00 |
| + | LT BAS | \$167.20 |
| = | Cost per month | \$5,831.70 |
| X | number of months | 24 |
| = | Total LT Cost | \$139,960.80 |

The government costs associated with each rank are added to estimate the total government cost of this officer over six years:

$$\$80,301.60 + \$107,478.00 + \$139,960.80 = \mathbf{\$327,740.40 \text{ per Scholarship officer}}$$

C. NET COST PER NON-PARTICIPANT OFFICER AT SIX YEARS

To determine non-participating officer costs, the same model was used. The values were the same as the Scholarship program since the government absorbs no education costs in either case. It should be noted that though the net financial costs are the same at the six-year point, non-participants did not have the additional human capital investment in the form of graduate education while serving in their initial fleet tours. Their additional fleet experience (since they did not attend graduate school and instead entered fleet service directly) will likely be offset by significantly higher graduate education costs for those who choose to stay and complete a Master's degree at government expense.

D. COST DISCUSSION

For the sake of simplicity, additional pays such as sea pay, submarine pay, and hazardous duty pays were ignored. The additional pays were deemed insignificant to the overall point of the analysis. The only possible exception noted would be submarine pay, which for a LT>4yrs is \$510 per month. This compensation, like all other special pays,

would make the cost of a six-year submariner higher, thus amplifying the relative cost-savings associated with higher retention for this group.

E. NET PROGRAM COSTS PER OFFICER

Using the previously determined retention statistics and the costs per program, an analysis of costs and benefits was conducted. As previously noted, all costs to the government have been set at relatively conservative values and certain forms of compensation have been ignored for simplicity. Had these forms of compensation been included, they would have increased the overall cost of nurturing an officer to the six-year point. This would have amplified any cost savings found and would have further demonstrated the cost efficiency of retaining officers as compared to recruiting and training new accessions.

The cost comparisons shown will emphasize post-commissioning time and associated direct costs. Since the entire sample is made up of USNA graduates, any benefits due to differences in retention would be significantly amplified if USNA costs were included. With a cost of \$275,001 per graduate (USNA 2003) (cost estimates vary yearly based on budgets and the number of midshipmen in the brigade), the cost savings associated with higher retention would be very high. Furthermore, cost estimates do not include such costs as Naval Nuclear Power School, Surface Warfare Officer School (SWOS), and Basic Underwater Demolition/SEAL (BUD/S). Adding these training costs in would add millions of dollars to the cost of officers reaching the six-year point. By retaining instead of recruiting and retraining, many of these initial training costs would be avoided, saving the government untold millions of dollars.

Cost benefit analysis can only be reliably conducted when the retention effects of the graduate education programs (in Chapter IV) were statistically significant. Coefficients failing to reach the statistical significance threshold of 95% were not considered reliable, therefore program retention rates are assumed not to vary significantly from non-participant rates. Accordingly, cost comparisons for non-significant programs have been conducted using non-participant predicted retention rates.

Cost comparisons were conducted by determining the statistical retention likelihood for program participants and/or non-participants, as appropriate. This was

expressed as a percentage of cases where the officer could be reliably (95%) expected to remain in service to the six-year point. In order to compare different scenarios (VGEP, Scholarship, or non-participant) the equations were set up to determine the cost to produce one officer remaining in service to the six-year point. This involved inverting the retention percentage to estimate the number of officers needed to achieve a single officer at six years:

$$1/\text{Retention Rate} = \text{number of officers required to produce 1 six-year officer}$$

The estimated cost was determined by multiplying the number of officers required to produce one officer at six years by the cost per officer. The values calculated were estimates, therefore all calculated values were rounded to whole dollars:

$$\# \text{ of Required Officers} \times \text{Cost per Officer} = \text{Net Program Cost}$$

F. ADJUSTED PROGRAM COSTS PER OFFICER

If officers are attending graduate school instead of proceeding to the fleet, additional officers must be found to fill the vacant billets in order to maintain fleet manning levels. To objectively evaluate the cost of the programs, it is necessary to determine the cost of the additional officers required to fill billets which would otherwise be left unfilled by officers in an early graduate education program. This calculation takes the inverse of the actual fleet time divided by the total time spent in the program and fleet together (which, in this thesis, is the six-year point). By determining the inverse of the actual productive fleet time, the costs can be determined by multiplying this result by the cost per participant for the respective program. Since the costs are broken down by community, and all officers within a given community attend the same schools and complete the same training pipelines, regardless of program affiliation, any time spent outside an early graduate education program is considered to be useful time spent within the community. Thus, only the time spent within an early graduate education program will be counted as “opportunity cost” or time spent outside what would normally be expected of an officer within that community. Thus, the equation is as follows:

$$1/(\text{fleet time}/6 \text{ years}) \times \text{Net Program Cost} = \text{Adjusted Total Program Cost}$$

For the six-month (0.5 years) VGEP program the Adjusted Total Program Cost is:

$$1/(5.5 \text{ years}/6 \text{ years}) \times \$337,740.40 = \$368,444 \text{ per VGEP participant}$$

Using the same equation for the Scholarship program, the Adjusted Total Program Cost would be:

$$1/(4 \text{ years}/6 \text{ years}) \times \$327,740.40 = \$491,611 \text{ per Scholarship participant}$$

Using the above information, it can be stated that VGEP participants incur an estimated \$30,704 in opportunity costs while Scholarship participants incur an estimated \$163,871 in additional costs per participant.

Since non-participants did not assume any opportunity cost for early graduate education and spent the entire 6 years performing duties within their communities, non-participant costs remained at **\$327,740 per non-participant.**

G. POOLED SAMPLE

In the Pooled Sample retention model both VGEP and Scholarship participants statistically significant. For all 1013 officers, including the 65 VGEP and 127 Scholarship recipients, the probability of retaining to the six-year point was a 67.90%.

When marginal effects were run for VGEP participants only, the predicted result was 84.87%. Thus, 1.18 VGEP officers must be accessed and trained to produce one officer at the six-year point ($1/84.87 = 1.18$)

When 1.18 officers is multiplied by the adjusted cost of a VGEP participant, the Total Cost per six-year VGEP Officer is determined for the Pooled Sample:

$$1.18 \text{ Officers} \times \$368,444 = \$434,764 \text{ Total Cost per six-year VGEP Officer}$$

The marginal effects for Scholarship recipients produced a statistical retention likelihood of 84.78%. Thus, 1.18 Scholarship officers must be accessed and trained to produce one six-year officer ($1/84.87 = 1.18$).

1.18 officers are multiplied by the adjusted Scholarship cost, resulting in the Total Cost per six-year Scholarship Officer for the Pooled Sample:

$$1.18 \text{ Officers} \times \$491,611 = \$580,101 \text{ Total Cost per six-year Scholarship Officer}$$

The marginal retention effect of non-participants was 62.75%. Thus, 1.59 non-participants must be accessed and trained to produce one non-participant at six years of service.

$1/62.75\% = 1.59$ officers required to produce 1 six-year officer.

When 1.59 officers is multiplied by the non-participant cost, the result is \$521,107.

1.59 Officers X \$327,740 = \$521,107 (Non-participant cost per six-year officer)

Using the total-cost-per-officer, the VGEP and Scholarship programs can be compared with non-participants. These are displayed in Table 17.

Table 17 Pooled Sample Cost Savings.

| Program | Cost per officer | Cost Savings |
|--------------------------------|-------------------------|---------------------|
| VGEP (N=65) | \$434,764 | \$86,343 |
| Scholarship (N=127) | \$580,101 | <i>(\$58,994)</i> |
| non-participant (N=821) | \$521,107 | N/A |

In the full sample, the cost savings associated with early graduate education are modest. VGEP was discovered to have an estimated net benefit of \$86,343 over a non-participant, whereas Scholarship had an apparent net loss of \$58,994 per participant. These calculations do not include millions of dollars in training costs and experience value lost when non-participants leave the Navy at a higher rate. Further, any performance improvements that are based on the human capital improvements from graduate study are ignored. Also, in order to be most competitive for advancement and billet screening boards, non-participants often must obtain a graduate degree (Jordan (1991), Talaga (1994), Fuchs (1996), Bowman & Mehay (1999 & 2002), and Phillips (2001). Since this is often accomplished at government expense, the cost of non-participant officers who remain in service may rise sharply near the end of, or immediately after, the six year point. The cost savings calculated in this study do not account for those non-participants who later obtain a graduate degree. Again, the costs of sea pay, submarine pay and hazardous duty pay have been ignored in this study. These would further increase the cost difference associated with those who leave the Navy.

H. SURFACE WARFARE OFFICERS

For the 195 SWOs analyzed, the predicted retention rate was 71.24%. The actual overall retention rate was 32.31% (63 of 195). The predicted VGEP retention rate was 93.71%. The predicted Scholarship retention rate was 80.35% though the program's retention variable was insignificant. Non-participant's predicted retention rate was 67.05% whereas the sample retention rate was 22.89% (38 of 166). This disparity between predicted and sample retention cannot be explained.

Calculations were made to estimate cost-savings in a similar manner to the "Pooled Communities" calculations. For VGEP participants it required 1.07 officer accessions to produce one six-year officer.

$$1/93.71 = 1.07 \text{ officers required to make 1 six-year officer.}$$

When 1.07 is multiplied by the adjusted VGEP cost, the result is \$394,235.

$$1.07 \times \$368,444 = \$394,235 \text{ (VGEP cost per six-year officer)}$$

For Scholarship participants the marginal retention value was not statistically significant, meaning there is no reliable retention difference between Scholarship and non-participants. Therefore, the non-participant predicted retention rate is used for cost analysis and 1.49 officers are required to produce one six-year officer at a cost of \$732,500.

$$1/67.05\% = 1.49 \text{ officers required to make 1 six-year officer.}$$

$$1.49 \times \$491,611 = \$732,500 \text{ (Scholarship cost per six-year officer)}$$

The same calculation was conducted for non-participants. Non-participants required 1.49 officers to produce one six-year officer at a cost of \$488,333.

$$1/67.05\% = 1.49 \text{ officers required to make 1 six-year officer.}$$

$$1.49 \times \$327,740 = \$488,333 \text{ (non-participant cost per six-year officer)}$$

Table 18 shows the cost savings for the Surface community. These values were calculated using statistically generated predicted retention rates. Had this calculation for non-participants been conducted using observed retention data, the costs per non-

participant officer would have been significantly higher and Scholarship much lower, making Scholarship more cost-effective.

Using predicted retention rates, VGEP posted a \$94,098 cost savings per officer. Scholarship, whose retention rate was not statistically different from non-participants, was estimated to cost nearly a quarter-million dollars per officer more than non-participating officers. This is largely due to the two-years worth of opportunity cost in the form of missed fleet time which added an estimated \$163,871 per officer to the cost. Opportunity cost, combined with no positive retention effects, showed the Scholarship program to be an expensive investment.

Table 18 SWO Cost Savings.

| Program | Cost per officer | Cost Savings |
|--------------------------------|-------------------------|---------------------|
| VGEP (N=14) | \$394,235 | \$94,098 |
| Scholarship (N=15) | \$732,500 | (\$244,167) |
| non-participant (N=166) | \$488,333 | N/A |

VGEP is a very cost-effective investment based on retention and associated costs for the Surface Warfare Community. Scholarship is not beneficial on a strictly cost basis.

I. SURFACE WARFARE OFFICERS (NUCLEAR)

For the 92 NSWOs analyzed, the predicted retention was 53.67%. The VGEP program did not meet the significance threshold but was predicted to have 70.76% retention. The Scholarship program was observed to be significant and positive with respect to retention at MSR+1. Predicted retention was 84.45% at the six-year point. Non-participants were much more likely to leave the service before six years; Predicted retention was 46.17%.

Again, calculations were made to estimate cost-savings in a similar manner to the “Pooled Communities” calculations. For the limited sample of VGEP participants, the predicted retention was not significantly different than non-participants so non-participant predicted retention had to be used. It was calculated that it would require 2.14 officer accessions to produce one six-year officer at a cost of \$788,470.

$$1/46.17\% = 2.14 \text{ officers required to make 1 six-year officer.}$$

$$2.14 \times \$368,444 = \$788,470 \text{ (VGEP cost per six-year officer)}$$

For Scholarship participants there was a reliable retention difference, therefore non-participant predicted retention was used. This calculation showed that 1.18 officers were required to achieve one six-year officer at a cost of \$580,101.

$$1/46.17 = 1.18 \text{ officers required to make 1 six-year officer.}$$

$$1.18 \times \$491,611 = \mathbf{\$580,101} \text{ (Scholarship cost per six-year officer)}$$

The same calculation was conducted for non-participants. Non-participants required 2.14 accessions to produce one six-year officer at a cost of \$701,364.

$$1/46.17\% = 2.14 \text{ officers required to make 1 six-year officer.}$$

$$2.14 \times \$327,740 = \mathbf{\$701,364} \text{ (non-participant cost per six-year officer)}$$

Table 19 NSWO Cost Savings.

| Program | Cost per officer | Cost Savings |
|-------------------------------|-------------------------|---------------------|
| VGEP (N=7) | \$788,470 | <i>(\$87,106)</i> |
| Scholarship (N=11) | \$580,101 | \$121,263 |
| non-participant (N=74) | \$701,364 | N/A |

Within the Nuclear SWO community, Scholarship actually enhanced retention and VGEP did not hurt retention (VGEP was not statistically significant though predicted and observed retention rates far exceeded non-participants). The lack of statistical significance indicated there was no reliable difference between VGEP participants and non-participants in the NSWO community. This proves the null hypothesis, that VGEP recipients do not leave the service at a differing rate than non-participants.

VGEP was determined to cost an estimated \$87,106 more per officer than an officer with no early graduate. This apparent loss is caused by a combination of direct education costs, opportunity costs associated with the VGEP program as well as opportunity cost in the form of missed fleet time. The estimated cost savings of the Scholarship program exceeded \$120,000 per officer without taking any nuclear-related recruiting or training into account. Figures for estimating the cost of nuclear power training are unavailable but they would add many millions to the cost of producing officers within the community, thus making Scholarship even more cost-effective.

The indicated cost-loss of the VGEP program was caused by the government incurred costs of VGEP (again, opportunity costs and direct education costs). There is no way to determine if receiving VGEP prevented additional personnel losses and thus might have minimized further financial loss to the Navy within the NSW community. Neither, the human capital theory of performance improvements inherent in an officer receiving graduate education, nor the costs of providing non-participant officers with that graduate education are included in these analysis.

J. SUBMARINE WARFARE OFFICERS (NUCLEAR)

For the 460 submariners analyzed, the predicted retention rate was 75.35%. Both VGEP and Scholarship were observed to significantly improve retention at the six year point. VGEP predicted retention was 92.59%. Scholarship retention was a similarly impressive 90.97%. For non-participants, the retention dropped dramatically. Predicted retention for non-participants was 65.99%.

To maintain comparability between communities, calculations were again made to estimate cost-savings in a similar manner to the “Pooled Communities” calculations. For VGEP participants where there was a statistical difference in retention, 1.08 accessions were required to produce one six-year officer at a cost of \$397,920.

$$1/92.59\% = 1.08 \text{ officers required to make 1 six-year officer.}$$

$$1.08 \times \$368,444 = \$397,920 \text{ (VGEP Cost per six-year officer)}$$

Similarly, for Scholarship participants who were also significantly different than non-participants, 1.10 accessions were required to produce one six-year officer at a cost of \$540,772.

$$1/90.97\% = 1.10 \text{ officers required to make 1 six-year officer.}$$

$$1.10 \times \$491,611 = \$540,772 \text{ (Scholarship cost per six-year officer)}$$

The same calculation was conducted for non-participants. Non-participants required 1.52 officer accessions to produce one six-year officer at a cost of \$498,165.

$$1/65.99\% = 1.52 \text{ officers required to make 1 six-year officer.}$$

$$1.52 \times \$327,740 = \$498,165 \text{ (non-participant cost per six-year officer)}$$

Table 20 Submariner Cost Savings.

| Program | Cost per officer | Cost Savings |
|--------------------------------|-------------------------|---------------------|
| VGEP (N=35) | \$397,920 | \$100,245 |
| Scholarship (N=87) | \$540,772 | (\$42,607) |
| non-participant (N=338) | \$498,165 | N/A |

For the submarine community, VGEP cost-savings are estimated at \$100,245 while the Scholarship program is estimated to post an apparent cost-loss of \$42,607. The VGEP cost savings are a result of significantly improved retention coupled with a relatively low cost-of-opportunity (only six-months missed fleet time). As with other communities, the Scholarship cost-loss is due to high opportunity costs in the form of two years missed fleet time which added an estimated \$163,871 per officer to the program cost. Without accounting for missed fleet time, Scholarship would have posted an impressive cost-savings for the submarine community.

All predicted retention values were closely met by observed retention in the submarine community. Having one of the longest training pipelines and the largest pay and bonus rate in the research population, NSUBs are very expensive to train and retain.

As with NSWOs, costs associated with nuclear training and submarine school are unavailable. Adding these additional training costs would likely add hundreds of thousands of dollars to the per officer costs shown. The fact that both programs have a significant, positive effect on retention cannot be overstated. With these extremely valuable officers, the retention ratios have even more fiscal impact. NSUB is the community where the overall impact of the programs is felt most.

K. SPECIAL WARFARE/OPERATIONS OFFICERS

For the 85 officers observed in the Special Warfare/Special Operations community predicted retention was 72.47%. Neither VGEP, nor Scholarship were significantly linked to retention at six years. VGEP predicted retention was 48.90%. Scholarship predicted retention was 61.10%. Non-participants were predicted to have a 74.06% retention likelihood.

Calculations were made to estimate cost-savings in a similar manner to the “Pooled Communities” calculations. For VGEP and Scholarship participants there was no statistically significant difference in VGEP and non-participant retention so the non-

participant retention rate must be used for retention estimation. Thus, it takes participants and non-participants each 1.35 officer accessions to make one six-year officer.

$$1/74.06\% = 1.35 \text{ officers required to make 1 six-year officer.}$$

Though retention is assumed to be the same due to the lack of significance, the costs per officer vary due to the differences in the program. VGEP officers cost \$497,399 to make one six-year officer.

$$1.35 \times \$368,444 = \$497,399 \text{ (VGEP cost per six-year officer)}$$

Similarly, for Scholarship participants the cost per six-year officer was \$663,675.

$$1.35 \times \$491,611 = \$663,675 \text{ (Scholarship cost per six-year officer)}$$

The same calculation was conducted for non-participants resulting in a \$442,450 cost per officer.

$$1.35 \times \$327,740 = \$442,450 \text{ (non-participant cost per six-year officer)}$$

Table 21 SpecWar/SpecOps Cost Savings.

| Program | Cost per officer (est.) | Savings vs. non-participants (est.) |
|-------------------------------|--------------------------------|--|
| VGEP (N=3) | \$497,399 | (\$54,949) |
| Scholarship (N=6) | \$663,675 | (\$221,225) |
| non-participant (N=76) | \$442,450 | N/A |

Both programs were observed to be non-significant with respect to retention at six years, thus proving the null-hypothesis, that SpecWar/SpecOps officers do not leave the Navy at differing rates than non-participants. Though not significant with respect to retention, the cost ratios for both VGEP and Scholarship showed higher estimated costs than for non-participants due to direct education and opportunity costs incurred by the government. As with previous communities, the opportunity costs associated with Scholarship program in the form of missed fleet time were significant. The Scholarship had an estimated cost-loss of over \$220,000 per participant, of which \$163,871 can be attributed to opportunity cost.

Though both programs appear to have higher costs-per-officer, the number of VGEP and Scholarship participants in the SpecWar/SpecOps community was extremely small (N=3 and 6, respectively) making any single officer's decision to stay or leave

much more important than would otherwise be felt. These cost-figures must be taken in context of the extremely limited sample and not be overstated simply by their overall size or value.

Based on this limited sample, graduate education does not appear to be a cost-effective investment for this community. However, a larger sample or longer research timeframe might be required to definitively state SPEC graduate education is not a wise investment. That determination is beyond the scope of this study. Clearly, SPEC graduate education was not as important as it was observed to be within the nuclear communities (NSWO and NSUB).

L. OTHER COMMUNITIES

For the 181 remaining officers grouped under the “Other Communities” variable, predicted retention was 58.73%. Neither VGEP, nor Scholarship, was observed to be significant in relation to retention at the six-year point. VGEP predicted retention was 32.21% and Scholarship retention was predicted at 61.13%. Though both VGEP and Scholarship observed retention rates were very close to their respective predicted rates, due to the small number of participants in both programs, the reliability the predicted retention rates is questionable. Non-participant retention was predicted at 58.73%.

Calculations were made to estimate cost-savings in a similar manner to the “Pooled Communities” calculations. For all officers there was no statistically significant difference in retention therefore the non-participant retention rate must be used to determine costs. For all officers, it was determined that these lumped communities would require 1.70 officer accessions to produce one six-year officer.

$$1/58.73\% = 1.70 \text{ officers required to make 1 six-year officer.}$$

As with the SPEC community, the costs varied based on program costs. For the VGEP program, 1.70 officers were projected to cost \$626,355.

$$1.70 \times \$368,444 = \mathbf{\$626,355} \text{ (VGEP cost per six-year officer)}$$

Similarly, for Scholarship participants, the 1.70 officers were projected to cost \$835,739.

$$1.70 \times \$491,611 = \mathbf{\$835,739} \text{ (Scholarship cost per six-year officer)}$$

The same calculation was conducted for non-participants. Since there was no statistical difference in retention and the government absorbed no direct graduate education costs in the Scholarship program, the resulting cost per officer for non-participants matched the Scholarship value of \$557,159.

$$1.70 \times \$327,740 = \mathbf{\$557,159 \text{ (non-participant cost per six-year officer)}}$$

Table 22 illustrates the relative cost savings of VGEP and Scholarship within the “Other Communities” grouping.

Table 22 Other Communities Cost Savings.

| Program | Cost per officer | Cost Savings |
|--------------------------------|-------------------------|---------------------|
| VGEP (N=6) | \$626,355 | <i>(\$69,196)</i> |
| Scholarship (N=8) | \$835,739 | <i>(\$278,580)</i> |
| non-participant (N=167) | \$557,159 | N/A |

As with the SPEC community, the results for the OCOMM need to be taken in context. Though predicted and actual retention were similar, the small number of participant officers in both programs limited the applicability of any results to this sample alone. Also, this grouping was largely support officers who were not placed (based on community) into any other variable grouping. Except for the 75 officers lumped into “Medical”, there are few enough officers in any given community to analyze with any legitimate measure of reliability. Cost comparisons were completed in the interest of thoroughness and research though further applicability of the results would have to be validated by additional research using a larger sample or longer research time period.

As with the Special Warfare/Special Operations community, Scholarship appeared to cost significantly more per officer. Again, this is caused by the heavy opportunity costs associated with the Scholarship program, which are not incurred by non-participants.

VI. CONCLUSIONS AND RECOMMENDATIONS

Several binary logit regression models were estimated to determine if variables previously shown to affect officer retention were related to retention in this study. The resulting logits were further analyzed to determine the marginal effect of each independent variable on retention. Logit models were estimated for the entire sample of graduates as well as for five separate sub-groups. By breaking officers down into communities, the effect of community affiliation was eliminated and officers in similar career paths could be compared.

A. POOLED SAMPLE

When the overall sample of officers (having an OOM in the top 200) was analyzed, it was determined that NSWOs were 17.8% more likely to exit the Navy before the six-year point than the reference community (conventional SWO). This could possibly be due to the dot-com and technology-intensive hiring frenzy of the mid to late 1990s. Engineers in many fields were making significant salaries to fuel the huge technology boom in the civilian sector, possibly drawing NSWOs out of the Navy. However, this hypothesis is contradicted by Group1 majors (engineers) who were no more likely to leave than other majors.

For the pooled sample, both VGEP and Scholarship recipients are about 26% more likely to remain in service at the six-year point than non-participants. This is a direct refutation of the major research hypothesis, namely that program participants would be more likely to leave the Navy. This finding does support a major theme found during the literature review: graduate education tends to improve retention. For the Pooled Sample it could be said, using logic previously presented, that the Navy is gaining a return on its investment in graduate education through the VGEP and Scholarship programs. Program participation has an important positive effect on officer retention.

Regarding the cost effectiveness of the programs, VGEP is estimated to save the government over \$86,000 per participant while Scholarship is estimated to cost nearly \$59,000 per officer more than a non-participant. With the sheer amount of money involved in growing officers, and the cost of lost experience when officers leave the Navy, it is the contention of the author that the additional cost of 12% per officer may be

largely offset by other benefits such as human capital improvements and retained experience for those who receive graduate education through the Scholarship program. VGEP is assessed to be cost-effective while Scholarship is assessed to be only marginally cost-effective, on average, for all officer communities. The sections below summarize the results for each separate officer community.

B. SURFACE WARFARE OFFICERS

Participation in VGEP was observed to have a positive impact on retention of SWOs at the six-year point. This is a direct refutation of the research hypothesis that highly educated officers would be more likely to be drawn out of the Navy during the booming civilian economy of the mid to late 1990s. Remembering that VGEP participants are largely non-technical majors, it is possible VGEP graduates were not drawn into the civilian sector since they would not fit the ideal mold for a technical position with a civilian employer. Even accounting for opportunity costs necessary to maintain fleet manning levels at current levels, VGEP posted a cost-savings of over \$94,000, making it a solid investment for the SWO community.

The Scholarship program did not have a statistically significant retention effect. The large opportunity costs combined with no differences in retention (compared to the comparison group) caused Scholarship to post an estimated loss of nearly a quarter-million dollars. Scholarship does not appear to be a good investment for the SWO community.

C. SURFACE WARFARE OFFICERS (NUCLEAR)

The propensity for NSWOs to leave was observed in the pooled sample. Within the Surface Warfare Officer (Nuclear) sample, it was observed that Group 2 majors were 35.6% more likely than the reference major (Group 1) to remain on active duty until at least six years. Again, this could be explained by the active civilian technical job market throughout the mid-1990s. Engineers may have been drawn out of the NSWO community into better paying civilian jobs.

NSWO Scholarship participants experienced a statistically significant 45.9% retention premium at the six-year point. This retention advantage for graduate education

recipients again supports the major theme found in the literature. With an estimated cost-savings of over \$120,000 per officer, Scholarship is clearly effective for this community.

There were only seven NSWV VGEF participants making definitive analysis difficult. The fact that VGEF was not statistically significant for NSWVs would support the null hypothesis that program participants are no more likely to leave the service before six years than their peers. There is a 12% cost premium associated with VGEF over non-participants estimated to be around \$87,000 per officer. As with the Scholarship program for the pooled sample, it is the contention of the author that this increased cost may be largely offset by other improvements in human capital. VGEF is only marginally effective for the Nuclear SWO community.

D. SUBMARINE WARFARE OFFICERS (NUCLEAR)

Both graduate education programs were significant and positive, meaning they were an important factor in junior submariner retention. VGEF participants were 34.6% more likely than non-participants to remain in service, while Scholarship participants were over 30% more likely to remain in service.

Bowman & Mehay (1999; 2002) found that, because of the high training costs associated with submarine officer development, the cost savings to the Navy of retaining submariners could be sizeable. It is the submarine community that is both the principal program participant and the most strongly affected by early graduate education. Within the submarine community, the Navy is definitely obtaining a significant return on the investment made in VGEF with a cost-savings slightly in excess of \$100,000 per participant. Scholarship is estimated to cost an estimated \$42,607 more than a non-participant. However, the secondary human capital improvements could make the Scholarship program is marginally effective.

E. SPECWAR/SPECOPS OFFICERS

The retention effects of the VGEF and Scholarship programs were not statistically significant for Special Warfare/Ops officers. It is highly possible that the technical revolution of the 1990s and resultant civilian hiring spree simply passed by the SEAL and diving officers. Largely operational in nature, these two communities have relatively little exposure to, and possibly little interest in, technology in the form of computers,

communications and wireless information transfer, the skills which dominated the technology revolution. Attempting the same cost-estimations for this community yield a moderate net cost for VGEP and a sizeable loss for Scholarship (\$55,000 and \$221,000, respectively). However, the secondary human capital benefits could easily offset the net costs for the VGEP program. Scholarship specifically is a poor investment.

F. ALL OTHER COMMUNITIES

The officers grouped under the “Other Communities” variable were a very diverse group. Medical community officers dominated the group with 75 of 181 officers. The retention behavior of early education participants in all “other communities” was not statistically different from non-participants. The small numbers of officers in many of the communities classified as “Other Communities” prevented additional investigation into the retention patterns of support officers.

As with the SpecWar/SpecOps communities, it is possible the technology revolution simply passed these support officers by. The largest group of officers in this diverse group were the medical officers which, from the researchers perspective, would not normally be expected to join the technology race. As with the SPEC community, it is difficult to financially justify either program in the Other Community group. Using previous logic, VGEP could be argued to be marginally effective since the early graduate education cost premium was only 12.4% (\$69,000 per participant). Scholarship is clearly not effective, posting an estimated \$278,000 net loss.

G. RETENTION SUMMARY

The estimated marginal retention effects of graduate education alone are summarized in Table 23.

Table 23 Graduate Education Retention Summary.

| VARIABLE | MEAN | LOGIT | SIG | MARGINAL |
|---------------------------------------|--------|--------------|--------------|---------------|
| Pooled Communities (N= 1013) | | | | EFFECT |
| VGEP | 0.06 | 1.203 | 0.001 | 0.262 |
| SCHOLARSHIP | 0.13 | 1.195 | 0.000 | 0.261 |
| SWO (N= 195) | | | | |
| VGEP | 0.0718 | 1.991 | *** | 0.408 |
| SCHOLARSHIP | 0.0769 | 0.698 | 0.323 | 0.143 |
| NSWO (N= 92) | | | | |
| VGEP | 0.0761 | 1.037 | 0.322 | 0.258 |
| SCHOLARSHIP | 0.12 | 1.845 | 0.050 | 0.459 |
| NSUB (N= 460) | | | | |
| VGEP | 0.0761 | 1.863 | 0.003 | 0.346 |
| SCHOLARSHIP | 0.19 | 1.647 | 0.000 | 0.306 |
| SPECWAR/SPECOPS (N= 85) | | | | |
| VGEP | 0.0353 | -1.093 | 0.518 | -0.218 |
| SCHOLARSHIP | 0.0706 | -0.597 | 0.550 | -0.119 |
| All Other Communities (N= 181) | | | | |
| VGEP | 0.0331 | -1.097 | 0.254 | -0.267 |
| SCHOLARSHIP | 0.0442 | 0.100 | 0.905 | 0.024 |

For the pooled sample containing all 1013 officers in all communities, both VGEP and Scholarship participants were 26% more likely to remain in service until the six year point. For SWOs, VGEP added 40% to the retention likelihood. Nuclear SWOs in the Scholarship program had the greatest retention difference between participants and non-participants. The submarine community was perhaps the one most affected with both programs yielding over a 30% retention gain at the six-year point.

Coupled with opportunity costs, these surprisingly large retention effects drove the financial model to a very large degree. However, some communities contained very limited samples of graduate education participants. Some apparent cost-inefficiencies can be explained by the fact that participants in those communities did not exhibit different retention behavior than non-participants but incurred costs which non-participants did not incur. As has been shown, the \$163,871 Scholarship opportunity cost was significant, requiring a very sizeable retention increase to overcome. However, the analysis in this

thesis was not able to quantify the value of the additional human capital that was created by the early graduate education programs. This thesis, while not concentrating on the secondary human capital effects, attempted to make modest allowances for these factors by comparing a minimal net loss to the secondary benefits. Specifically, Pooled Community, NSW0, SPEC and Other Community VGEP participants fall into this category, as do Submariner Scholarship participants. It is unlikely that a negative “cost-benefit” ratio would be obtained in these cases if the full range of benefits could be evaluated.

H. COST SAVINGS

The cost savings calculated in Chapter V are considerable. They are summarized in Table 24. For this sample, VGEP saved the Navy an average of \$86,000 per officer in reduced attrition by the six year point. In strictly financial terms, the Scholarship program showed an estimated net loss of \$58,994. At least one of the graduate education programs had a significantly positive effect on retention (with resultant cost savings) in every community, except the SpecWar/ SpecOps community and the “Other Community” grouping.

For VGEP participants’ service, though it costs the government \$42,607-\$69,196 more per officer than non-participants’ service, it can be argued they are worth more due to improved efficiency and ability to grasp their role in “the big picture” (Sarkesian, Williams, & Bryant, 1995). Scholarship was more difficult to economically justify as it currently exists due to large estimated cost-losses for three of the five community groupings. Only in the Nuclear SWO community did the Scholarship program show significant monetary returns on investment. For the submarine community, the additional human capital benefits may offset what would otherwise appear to be a cost-loss. The Nuclear SWO and Submarine communities sufficiently dominated the overall sample that it could be argued secondary that human capital effects may mitigate the apparent losses for the overall sample. However, the magnitude of losses in the SWO, SpecWar/SpecOps, and Other Communities groupings made this position tenuous at best.

The positive, statistically significant, retention outcome for program participants demonstrates that offering early graduate education improves retention of the most

valuable officers. Statistically speaking, officers stayed who were otherwise expected to leave the Navy. This is beneficial to the Navy on several levels.

Table 24 Cost Savings Per Officer by Community.

| | Cost per officer | Cost Savings |
|---------------------------|-------------------------|---------------------|
| Pooled Communities | | |
| VGEP (N=65) | \$434,764 | \$86,343 |
| Scholarship (N=127) | \$580,101 | (\$58,994) |
| non-participant (N=821) | \$521,107 | N/A |
| SWO | | |
| VGEP (N=14) | \$394,235 | \$94,098 |
| Scholarship (N=15) | \$732,500 | (\$244,167) |
| non-participant (N=166) | \$488,333 | N/A |
| NSWO | | |
| VGEP (N=7) | \$788,470 | (\$87,106) |
| Scholarship (N=11) | \$580,101 | \$121,263 |
| non-participant (N=74) | \$701,364 | N/A |
| NSUB | | |
| VGEP (N=35) | \$397,920 | \$100,245 |
| Scholarship (N=87) | \$540,772 | (\$42,607) |
| non-participant (N=338) | \$498,165 | N/A |
| SPEC | | |
| VGEP (N=3) | \$497,399 | (\$54,949) |
| Scholarship (N=6) | \$663,675 | (\$221,225) |
| non-participant (N=76) | \$442,450 | N/A |
| Other Communities | | |
| VGEP (N=6) | \$626,355 | (\$69,196) |
| Scholarship (N=8) | \$835,739 | (\$278,580) |
| non-participant (N=167) | \$557,159 | N/A |

First, the improved retention means more officers are available in the fleet and that fewer officers need to be recruited to fully man the fleet. Recruiting costs for officers are not inexpensive. Most often, officers are grown through NROTC or USNA, which are costly and time-consuming commissioning programs. Officer Candidate School (OCS) acts as a surge volume in the officer training pipeline, producing officers quickly and at a relatively low cost. Here, the costs are limited to recruiting and training but are still not trivial.

A second benefit of improved retention is the increased pool of candidates to fill senior Navy billets. The hallmark of a Navy career is command at sea. Retaining more high quality officers allows more selective screening for these critical posts. More highly qualified senior officers can have a significant impact on Navy retention within their own commands, further improving the retention situation at all staffing levels. Offering programs like early graduate education and other distinctive rewards recognizes high performers and leads to job satisfaction, retaining our best officers (Sarkesian, Williams & Bryant, 1995).

The cost analysis determined that the Navy's cost-per-officer was significantly lower for early graduate education programs than for non-participants. The improved retention in all warfare areas, except Special Warfare and Special Operations more than covered the cost to the government. The limited number of graduate education participants in the SpecWar/SpecOps and Other Community groupings may have accounted for the insignificant results in these communities.

Based on demonstrated positive retention effects of the most prized USNA graduates, it is difficult to conclude that the VGEP and Scholarship programs are not effective for retention. When the costs of this retention are estimated, a more accurate picture of the programs effectiveness is created. Compared to a non-participating officer, the cost of offering an officer early graduate education is high. However, when the cost of an officer receiving early graduate education is compared to an officer receiving graduate education later in his/her career, a more positive picture can be painted. In either case, graduate education does not come cheaply. For a relatively small financial and time input, the Navy is able to utilize an officer with a graduate degree for the duration of their fleet service without incurring higher costs later in the officer's career.

Though not analyzed in this study, the ability of an officer to obtain a graduate degree early in the career could potentially be more significant for aviators who undergo rigorous, expensive flight training and find it difficult to "leave the cockpit" for a tour to obtain a graduate degree. The positive effects of having a graduate degree have been demonstrated by numerous retention and promotion studies. Because flying skills atrophy

over time and aviators need to accumulate total flight hours, having a graduate degree prior to entering aviation service may be the best way to provide a graduate degree to this community.

The results of this study should provide an underestimate of the true net benefits of the graduate education programs. First, the time period coincides with a growing civilian economy where highly qualified officers were in high demand. Second, all possible costs have been included in the cost-analysis. It was not possible to include certain training costs to the overall cost of training an officer. Since (except for the SpecWar/SpecOps community, SWO Scholarship and NSWO VGEP) all warfare areas showed that early graduate education improved retention, including these costs would have added to the net effectiveness of the programs. Third, the value of an officer having an early graduate degree and not having to leave the community later (therefore allowing skills to atrophy) was not evaluated. Finally, the whole argument of human capital theory that production improvements should be associated with graduate education was largely ignored. The officers participating in early graduate education often have additional skills that can be utilized during their initial fleet tour.

Fleet returnee officers, especially those with the academic background of those in this study, can expect an opportunity to obtain a graduate degree at some point in their career, often after their initial sea tour. Few will accomplish a Master's degree at a cost under the \$10,000 threshold set for the VGEP program. Almost none will meet the zero cost to the government of the Scholarship program, especially in the technical disciplines that make up the large majority of majors for which scholarships are awarded. The Graduate Education Voucher limit is \$40,000, and the USNA LEAD program runs \$20,000 for a single-year, non-technical Master's degree program. Though estimates vary by program, Naval Postgraduate School resident programs can exceed \$160,000, exclusive of pay and allowance costs (Gates, Maruyama, Powers, Rosenthal, & Cooper, 1998, p. 14).

I. RECOMMENDATIONS

When comparing the cost-effectiveness of the two programs, it is important to note that the programs are fundamentally different. VGEP is a one year program which

starts during a Midshipman's First Class year and continues six months after USNA graduation. Due to the short length of time available to complete the degree, most of the participants are necessarily non-technical majors. Scholarship starts immediately after USNA graduation and runs for 24 months. A majority of Scholarship participants are technical majors such as chemistry or engineering. With the difference in major concentrations, it is not likely that many Scholarship participants could complete a Master's degree within the VGEP program. Thus, both programs are required to obtain the requisite mix of majors sought in fleet officers. While VGEP seems to be the more cost-effective program in this study, it would not be possible to obtain the same mix of majors using only VGEP.

Several recommendations are made to maximize the return on investment for the VGEP and Scholarship programs: First, the concurrent service obligations for commissioning and graduate education allow officers to avoid up to two years of fleet service by selecting for an early graduate education program. Using a consecutive service requirement would double the MSR incurred by most participants. The possibility of such a large service commitment might prevent midshipmen from applying for the programs. However, the retention success observed in this study does not support this option. A more moderate change is suggested, especially for the Scholarship program where the opportunity cost was relatively high due to two years of missed fleet service. In order to minimize any adverse effects on program applications, while attempting to maximize potential service returns, it is recommended that one year of service be added for every year of graduate education. This would translate into a seven year MSR for most of the program participants in this study and would spread program costs over six years instead of four.

The nuclear community was observed to benefit most from early graduate education. Setting aside additional quotas for these communities would allow more officers from these communities the opportunity to obtain a Master's degree and hopefully enlarge the body of officers attending early graduate education and remaining in service with their expensive training and experience.

The current cost of a Master's degree obtained at the University of Maryland is approaching the \$10,000 government-funding cap placed on VGEP participants and will likely exceed this cap within a couple years (University of Maryland, 2002; Kiehl & Craig, 2003, p. A1). Most prestigious private universities' fees already exceed this cap by a significant margin. Retention analysis supports substantially increasing the funding assistance provided to VGEP students. This would amount to a minimal increase in total program costs since most of the current costs come in the form of participant's pay and allowances.

By instruction, Scholarship students are required to secure scholarships which exceed 25% of tuition and fees (CNO, 1998, p. 3). For a prestigious private university, a minimal scholarship can still leave tens of thousands of dollars in unpaid education expenses for Scholarship students. Retention analysis supports expanding this program, even at moderate government expense. By offering some sort of reimbursement for tuition and fees not covered by scholarships, significant financial burdens could be lifted from affected students which may later influence their decision to leave the Navy in search of higher salaries. One way to do this at minimal government expense would be to allow Scholarship recipients to receive Navy tuition assistance (TA) to cover expenses not covered by scholarships. Even moderate direct education costs assumed by the government would only minimally affect the overall cost of the program. As with VGEP, the majority of the Scholarship program cost is accounted for by student pay, allowances.

Lastly, cost analysis for Naval Academy graduates shows VGEP to be an effective program. With a minimal increase in MSR in return for graduate education, it could be made even more cost effective. Scholarship produces desirable retention results though at a considerably greater cost. The Scholarship program is open to NROTC graduates, but there are few available quotas and they are tightly controlled. Instituting a limited program covering NROTC graduates, as well as possibly OCS graduates, might be cost-effective. Relaxing restrictions on the number of NROTC graduate education quotas may have a similar effect on officer retention from that source with potential cost savings to the Navy.

J. LIMITATIONS

One significant limitation of this study is the time period chosen for analyzing retention decisions. The results of this study reflect retention decisions at MSR + 1 year. Applicability of results to different time spans will have to be determined by future research. The results of this study could be validated, negated, accentuated or attenuated by estimating a similar retention model at a later point in an officer's career.

Another limitation is that only commissioned USNA graduates with five year MSRs are examined. Aviation and Marine Corps program participants were not analyzed.

Finally, the results of this study are applicable only to USNA graduates. Due to the unique selection criteria applicable to USNA, study results may not fully apply to NROTC or OCS accession sources.

K. FURTHER RESEARCH

There are several areas where further research would benefit the analysis of early graduate education. It remains to be determined to what extent midshipmen are applying for early graduate education programs to avoid fleet service time. This would likely involve a survey of those who applied for the programs. Also, what are the characteristics of the officers accepting graduate education who separated?

This thesis centered on Navy officers who attended a civilian university under the VGEP or Scholarship program. In order to determine the effects of the civilian environment on military officers, it may be beneficial to track these officers' career patterns. Are there performance differences between civilian graduate degree recipients and government-sponsored programs (NPS, NWC, etc.)? Selection and promotion rates could be analyzed to determine if there are differences in patterns for both groups.

The model was unable to determine how the civilian unemployment rate for college graduates affects officer retention? Retention rates and bonus manipulations could be compared against fluctuations in the civilian unemployment rate for college graduates.

Do civilian graduate education programs affect the "military-civilian gap" within the academic and educational community? To determine this would require surveys of

both the military and civilian (student and faculty) populations. Attitudes could be compared for those with no interaction and those who experienced civilian/military interaction in an academic environment.

Lastly, what officer characteristics can be solely attributed to graduate education and isolated from those qualities inherent in officers selected for graduate education? This would require access to students both before and after their graduate education experience. Attitudes taken from the students could be analyzed along with senior/subordinate comments about the student's performance and job accomplishment, both before and after the graduate education experience.

L. CONCLUSION

Based on retention data both VGEP and Scholarship programs appear to be well run with participants selected who will repay the investment made in graduate education in the form of retention. Based on the costs involved, moderate increases in retention do not always amount to cost savings, especially for the Scholarship program where over \$160,000 in opportunity costs need to be overcome. With the above recommended changes to the programs, it is believed based on the results of this study that early graduate education opportunities could be safely expanded in a limited manner without unduly threatening the positive results found. The cost effectiveness of the VGEP program within the submarine community and the Scholarship program within the Nuclear SWO community was especially high. Expanding early graduate education opportunities in a moderate fashion could significantly affect retention of junior officers, especially in the SWO and NSW communities where observed retention was well below that of the submarine community and pooled community sample.

Based on the largely significant retention results and the net benefits of the early graduate education programs, it is recommended that the USNA Graduate Education Committee continue basing selecting of applicants on the current criteria. VGEP and Scholarship are not awarded strictly on the basis of OOM. Many factors are considered when selecting participants and the higher retention rates through the overall sample as well as in various communities suggests that the USNA Graduate Education Committee (GEC) is doing a remarkable job of selecting candidates who will return the investment

made in them by the Navy. It is also recommended that the US Naval Academy Academic Dean, Graduate Education Committee, and Ms. Marjorie Roxburgh continue to pursue additional VGEP funding and Scholarship authorizations from the Navy Personnel Bureau in a concerted effort to expand both programs.

APPENDIX: REGRESSION LOGITS

| VARIABLE | Pooled communities | | SWO only | | NSWO only | |
|--------------------------|--------------------|--------------|---------------|--------------|--------------|--------------|
| | Logit | Signif | Logit | Signif | Logit | Signif |
| Grad Ed: | | | | | | |
| VGEP | 1.203 | 0.001 | 1.991 | *** | 1.037 | 0.322 |
| SCHOLARSHIP | 1.195 | 0.000 | 0.698 | 0.323 | 1.845 | 0.050 |
| Demographics: | | | | | | |
| GENDER | 0.261 | 0.301 | -0.313 | 0.529 | 0.199 | 0.845 |
| MINORITY | 0.344 | 0.233 | N/A | N/A | N/A | N/A |
| ATHLETE | 0.012 | 0.945 | -0.219 | 0.566 | -0.158 | 0.833 |
| Other (GROUP 1 omitted): | | | | | | |
| GROUP2 | -0.220 | 0.193 | -0.088 | 0.841 | 1.430 | 0.036 |
| GROUP3 | -0.251 | 0.194 | -0.154 | 0.709 | -0.117 | 0.855 |
| Community (SWO omitted): | | | | | | |
| NSUB | 0.150 | 0.469 | N/A | N/A | N/A | N/A |
| NSWO | -0.816 | 0.003 | N/A | N/A | N/A | N/A |
| SPEC | 0.150 | 0.608 | N/A | N/A | N/A | N/A |
| OCOMM | -0.435 | 0.064 | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | | | |
| YR88 | -0.651 | 0.034 | -0.795 | 0.411 | -1.938 | 0.178 |
| YR89 | -0.811 | 0.005 | -1.964 | 0.007 | N/A | N/A |
| YR90 | -0.639 | 0.032 | -1.485 | 0.071 | -1.261 | 0.545 |
| YR92 | -0.195 | 0.547 | -0.799 | 0.319 | -0.760 | 0.766 |
| YR93 | -0.806 | 0.010 | -1.642 | 0.047 | -1.992 | 0.366 |
| YR94 | -0.759 | 0.015 | -0.504 | 0.553 | -1.344 | 0.953 |
| YR95 | -0.342 | 0.276 | -0.189 | 0.822 | 0.415 | 0.208 |
| YR96 | 0.090 | 0.800 | -0.765 | 0.314 | N/A | N/A |
| Constant | 1.144 | 0.000 | 1.798 | 0.008 | 0.436 | 0.431 |
| Survey Statistics: | | | | | | |
| Model Chi-square | 86.299 | | 23.86 | | 24.874 | |
| -2 log likelihood | 1210.547 | | 221.515 | | 102.622 | |
| Number of Cases | 1013 | | 195 | | 92 | |
| Classification: | | | | | | |
| % Correct "0" | 72.9 | | 30.2 | | 68.9 | |
| % Correct "1" | 53.1 | | 89.4 | | 72.3 | |
| % Correct Total | 59.8 | | 70.3 | | 70.7 | |

*** Significant with single-tail calculation

APPENDIX: REGRESSION LOGITS (Continued)

| VARIABLE | NSUB only | | SPEC only | | Other Communities | |
|--------------------------|---------------|--------------|--------------|--------------|-------------------|--------|
| | Logit | Signif | Logit | Signif | Logit | Signif |
| Grad Ed: | | | | | | |
| VGEP | 1.863 | 0.003 | -1.093 | 0.518 | -1.097 | 0.254 |
| SCHOLARSHIP | 1.647 | 0.000 | -0.597 | 0.550 | 0.100 | 0.905 |
| Demographics: | | | | | | |
| GENDER | N/A | N/A | N/A | N/A | -0.080 | 0.835 |
| MINORITY | -0.679 | 0.077 | N/A | N/A | 0.600 | 0.349 |
| ATHLETE | 0.030 | 0.915 | 0.463 | 0.438 | 0.347 | 0.348 |
| Other (GROUP 1 omitted): | | | | | | |
| GROUP2 | -0.408 | 0.113 | -0.666 | 0.342 | -0.425 | 0.296 |
| GROUP3 | -0.130 | 0.721 | -0.245 | 0.690 | -0.562 | 0.259 |
| Community (SWO omitted): | | | | | | |
| NSUB | N/A | N/A | N/A | N/A | N/A | N/A |
| NSWO | N/A | N/A | N/A | N/A | N/A | N/A |
| SPEC | N/A | N/A | N/A | N/A | N/A | N/A |
| OCOMM | N/A | N/A | N/A | N/A | N/A | N/A |
| Year (1991 omitted): | | | | | | |
| YR88 | -0.744 | 0.135 | -1.956 | 0.067 | 0.634 | 0.378 |
| YR89 | -1.007 | 0.032 | -1.973 | 0.061 | 0.533 | 0.421 |
| YR90 | -0.604 | 0.213 | -1.593 | 0.139 | -0.470 | 0.478 |
| YR92 | 0.139 | 0.816 | -1.531 | 0.133 | -0.236 | 0.724 |
| YR93 | -0.853 | 0.105 | N/A | N/A | -0.949 | 0.125 |
| YR94 | -0.997 | 0.053 | -1.686 | 0.086 | -0.679 | 0.379 |
| YR95 | -0.622 | 0.262 | -0.983 | 0.342 | -1.213 | 0.083 |
| YR96 | 0.254 | 0.735 | 0.162 | 0.909 | 0.006 | 0.994 |
| Constant | 1.423 | 0.001 | 2.175 | 0.011 | 0.782 | 0.174 |
| Survey Statistics: | | | | | | |
| Model Chi-square | 53.647 | | 10.776 | | 20.090 | |
| -2 log likelihood | 494.121 | | 93.904 | | 227.899 | |
| Number of Cases | 460 | | 85 | | 181 | |
| Classification: | | | | | | |
| % Correct "0" | 59.2 | | 34.6 | | 78.5 | |
| % Correct "1" | 65.2 | | 93.2 | | 48 | |
| % Correct Total | 63.5 | | 75.3 | | 61.3 | |

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