

AIR COMMAND AND STAFF COLLEGE  
AIR UNIVERSITY

**IMPROVING THE AIR FORCE CIVILIAN GRADUATE EDUCATION SYSTEM  
THROUGH INCREASED USE OF EXTERNAL FUNDING FOR PHD CANDIDATES**

by

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### **Abstract**

Each year, the Air Force sends scores of officers to civilian universities to earn doctoral degrees. This is a significant monetary investment, involving millions of dollars in tuition as well as the larger cost of the officers' salary during their time in school. This paper argues that the Air Force could better capitalize on its educational investments by increasing the standard time allowed for a doctoral program from three years to four and one-half years, doing away with the prerequisite of a master's degree, and systematizing the use of external assistantships, grants, and fellowships to pay for tuition. These changes would have several benefits, including cost savings for the Air Force, a richer educational experience for the individual, and higher completion rates. By bringing its practices closer to civilian norms, the Air Force can also better position its officers for entrance into and success at higher-quality institutions. This paper provides an overview of the current Air Force system for graduate education resource allocation and summarizes relevant data on completion rates, sponsoring agencies, funding, and institutional quality indicators for recent doctoral graduates. Using this context, the likely ramifications of the proposed changes (both benefits and risks) are then considered.

## **Introduction**

### *Problem background*

The Air Force currently pays tuition for the majority of officers it sends to earn PhDs. In a time of constricting budgets for programs not directly supporting our current wars, external funds could provide badly needed support for advanced education within the Air Force. Given that the majority of doctoral candidates at civilian schools obtain external funding for their degrees (95 percent of students in technical fields),<sup>1</sup> Air Force doctoral students could be reasonably expected to obtain outside sponsorships for their degrees in most cases. Cost savings on tuition could perhaps be reallocated to purchase man years for graduate education, which are currently decreasing as the Air Force budget is squeezed by the competing demands—projected school quota requests far exceed the available funding available for Fiscal Year (FY) 2011.<sup>2</sup> Additionally, due to budgetary constraints, officers are not always permitted to attend the best possible degree program to which they could gain admission—top programs at private universities can be quite costly.

Several Air Force policies limit the ability of officer degree candidates to compete for external tuition funds. First, the Air Force routinely allocates only three man years for completion of the PhD. This is far shorter than the 7-10 years of continuous graduate school registration typically required for a civilian graduate student to earn a PhD.<sup>3</sup> This average time includes the two years or so that would be required for the student to earn a master's degree, since this figure is calculated for the total time between the earning of a bachelor's degree and doctoral degree completion. Taking this into account, an officer with a master's degree that followed the civilian student pace would earn a doctorate in five to eight years, still far in excess of the three years allotted by the Air Force Education Requirements Board (AFERB). The very

fact that statistics on time-to-doctorate are compiled in reference to the bachelor's degree hints at a second disconnect for Air Force practice, however: a master's is often not a prerequisite for a doctoral degree, and many civilian students do not earn one on their way to a PhD. Under half of doctoral recipients in the physical sciences, for example, possess a related master's degree.<sup>4</sup>

Instead of spending precious man years on a master's degree as an intermediate step to a doctoral degree, the Air Force could combine them with the current three-year doctoral allocations to create four and one-half-year or five-year programs that would permit officers to earn a doctoral degree directly from the bachelor's level. This would make Air Force degree candidates much more attractive to civilian faculty advisors for sponsorship with research assistantships, since the uninterrupted time spent on research would make the students more productive.

*The need for advanced education*

International society has long recognized the value of higher education for its workforce. As described by Becker in his seminal work on "human capital" theory,<sup>5</sup> an employer who invests in education for employees can expect their productivity to increase as a result. Furthermore, "higher education creates benefits to society above those to the individual—benefits in terms of growth, social cohesion and the transmission of values, and the transmission of knowledge for its own sake."<sup>6</sup> Barr warns, however, that "quantifying those benefits ... faces a series of difficulties, not least because it is hard to separate the effects of education from other determinants of a person's productivity."<sup>7</sup>

In discussing employer-sponsored education, Becker draws a distinction between "general" and "specific" training.<sup>8</sup> In this context, general training is that which provides skills or knowledge that would benefit any likely employer. Specific training, by contrast, is training or

education whose application is primarily of interest to the employer providing the training, with limited applicability elsewhere. According to Becker, an employer providing general training for an employee is not as likely to reap the benefits of the employee's resultant increase in productivity as in the case of specific training. The employee, whose increased knowledge and skills warrant greater compensation than before, may seek employment elsewhere. Despite these risks, however, "employer-financed general training is quite common."<sup>9</sup>

The Air Force provides its enlisted corps with a significant amount of specialized training, according to career specialty, via technical schools. Officer training, however, tends toward the "general" category. Examples of this include Professional Military Education (PME) schools such as Air War College (AWC) and Air Command and Staff College (ACSC), as well as Defense Acquisition University (DAU) courses. While one could argue that these schools focus on Air Force-specific needs, significant portions of officer professional education focus on general skills such as leadership, management, and writing. Graduate degrees, whether sponsored at AFIT or at civilian institutions, provide training that is almost entirely general in nature. The Air Force, therefore, needs to carefully consider the risk involved with officer retention when it sponsors officers for graduate school, as well as seek to mitigate these risks via sound policy.

Given the highly technological nature of Air Force missions, its leaders have traditionally placed greater emphasis (*i.e.*, funding) on graduate education in science and engineering than on the social sciences and the humanities. The prevailing perception is that, as managers of activities that rely on the development and acquisition of complex and technologically advanced equipment that will operate in air, space, and cyberspace, the officer corps needs to be well versed in the technical disciplines. At various times in Air Force history, leaders have believed

they were facing an “engineering shortage,” even going so far as to sometimes offer continuation incentive pay to scientists and engineers.<sup>10</sup> The majority of Air Force officers with technical graduate degrees obtain them through fully-funded programs (about 80 percent in both 1970<sup>11</sup> and 1977<sup>12</sup>). Many officers earn degrees through part-time programs (*e.g.*, with tuition assistance from the Air Force), but the majority of these are in non-technical fields such as “international studies or the social sciences.”<sup>13</sup> An examination of the numbers in 1970 makes it easy to understand why the Air Force would feel the need to train and retain officers with technical degrees. The physical and social sciences provide an illustrative comparison. In the social sciences, for 517 AFIT-sponsored master’s degrees, there were 513 degrees obtained through tuition assistance and over 1500 independently obtained degrees. In the physical sciences, for 684 AFIT-sponsored master’s degrees, there were 15 degrees earned using tuition assistance and 205 independently obtained degrees. These figures highlight the fact that degrees in science and engineering do not lend themselves to part-time study, nor are they easily obtained with long gaps between schooling. It is not surprising, therefore, that the Air Force would make significant investment in full-time education in engineering and the sciences. By contrast, it is somewhat surprising that, despite the great numbers of officers who can (and do) independently obtain master’s degrees in business and the social sciences, the Air Force sponsors about as many fully-funded master’s degrees in these fields as it does in science and engineering.<sup>14</sup> Even in these non-technical fields, however, the overwhelming majority of officers earning doctoral degrees while on active duty do so in full-time programs.

In recent years, calls have been made for greater emphasis on “cultural” awareness in professional military education.<sup>15</sup> This emphasis on the need for most (if not all) officers to have a basic background in international relations, cultural studies, and foreign language skills can be

attributed to recent military challenges in Iraq and Afghanistan. Coupled with recent budgetary cuts in acquisition programs for high-tech platforms, this emphasis on cultural awareness has created a climate where the ‘pendulum’ in military education is swinging a bit away from the technical and focusing on the value of education in general. This new focus has resulted in changes in PME curricula (*e.g.*, the inclusion of language training as part of ACSC).

Additionally, senior Air Force leadership has a renewed interest in ensuring that Air Force-sponsored education is of the highest possible quality. One example of this is the recent inquiry of AF/A1D by the Air Force Chief of Staff, General Schwartz, as to why more officers are not sponsored for degrees at top-tier universities.<sup>16</sup>

### *The importance of quality*

If a renewed emphasis on education will contribute to solutions for the challenges currently faced by the U.S. military, surely the quality of that education will matter. PME schools are contributing to the educational needs of military officers, but they are limited in what they can provide. In the words of Vitas, “professional military education -- from West Point to the senior schools and war colleges – is not sufficient to develop officers cognitively able to deal with these new nonmilitary tasks without compromising military professionalism. The depth of insight and inquiry needed is best found in civilian liberal arts graduate education, in contrast to technical and scientific graduate degrees.”<sup>17</sup> While anyone who has survived (or not survived) a class in statistical mechanics might judge as laughable his implication that scientific education lacks “depth of insight and inquiry,” his point that the most rigorous education in many fields might be offered outside of the military is well taken. He goes on to offer some possible reasons that PME schools do not match up well against top civilian universities: “frequent curriculum changes prevent a high level of sophistication in instruction or faculty,” “there is little

opportunity for in-depth thought ... among faculty and students,” and “senior service schools also possess few distinguished scholars, perhaps because of a systematic discouragement of thinkers in uniform.”<sup>18</sup> Vitas argues that civilian universities can offer “a diversity of behavior and views,”<sup>19</sup> and that “civilian graduate education should be retained as much for the integrative effects of exposure to civilian elite groups as for the academic discipline.”<sup>20</sup>

Similarly, AFIT cannot hope to compete with top civilian schools of science, engineering, or management in terms of breadth of faculty experience, span of the curriculum, or “depth of inquiry.” Reasons for this include the three-year time limit for PhD completion (or 18 months for a thesis-based master’s degree), the intense focus on “operational impact,”<sup>21</sup> and a faculty heavily staffed with active and retired military officers. Limited time for program completion limits the type and depth of research that can be undertaken. This time limit impacts not only the students, but also the military faculty who, themselves, were similarly limited when they obtained their PhDs. Being “operationally” focused is AFIT’s *raison d’être*. AFIT’s graduate programs concentrate on projects with direct relevance to the Air Force mission—an obvious strength from an operational perspective. From an institutional perspective, however, one might wish to cultivate a number of officers with a more diverse educational experience by sending them to the very best civilian universities. As stated in a report from the Army War College, “graduate education in civilian institutions forces the military officer to move into the mainstream of America.”<sup>22</sup> From a technical point of view, interacting with peers and faculty engaged in the full spectrum of scientific research can be an enriching experience in terms of the ideas that can be brought back to the Air Force technical community, and can help to foster personal relationships beneficial to both the individual and the Air Force.

It's important to note that the faculty at AFIT does, of course, recognize the need for diversity, and is doing its best to assemble a top-flight faculty. A perusal of AFIT's website<sup>23</sup> reveals a large fraction of the faculty to hold a degree from AFIT itself—fully *one third* of the faculty in the Engineering Physics department hold a PhD from AFIT. Despite what would be a surprisingly “inbred” faculty for a civilian institution, some of the military faculty members have been sponsored at civilian institutions for their doctoral degrees. Not many of the military faculty hold terminal degrees from top-tier institutions, however—doubtlessly for the reasons discussed above.

#### *Context of the present work*

The purpose of this paper is to argue for improvements in the way the Air Force manages its sponsorship of doctoral programs. The author advanced the same basic arguments in an earlier research paper<sup>24</sup> using a historical context, in which he presented the history of Air Force PhD sponsorship and discussed how its development created disconnects with current practice in civilian universities. This companion paper, in addition to drawing on that earlier work, provides complementary contextual understanding by providing recent data on the Air Force system for sponsoring doctoral degrees for its officers.

### **The Air Force Advanced Education System**

#### *The AFERB Process*

The Air Force has systematized the identification of personnel billets requiring a graduate degree. Air Force Instruction 36-2302 details the process by which needs are identified and prioritized.<sup>25</sup> Unit reports on advanced academic degree (AAD) needs flow up through the MAJCOMs to the Air Force Education Requirements Board (AFERB), which then approves and prioritizes these requirements.<sup>26</sup> Functional experts known as Air Force Academic Specialty

Monitors (ASMs) are appointed as advocates to “defend AAD quota requirements for their particular degree specialties at AFERB Working Group,” and to “track execution of quotas/man years.”<sup>27</sup> USAF/DPDE “serves as chair of the AFERB Working Group” and is the approval authority for exceptions to the policy that “officers selected to complete graduate education will complete this education in-residence at AFIT.”<sup>28</sup>

AU/CFRS provides the administrative orchestration for the annual process of requesting, submitting, deliberating, and approving AAD positions. Major Commands (MAJCOMs) designate a representative for the AFERB process, and then review their Unit Manning Document (UMD) positions that are designated as needing to be filled by someone holding an AAD. To be coded as an AAD position, “the incumbent cannot optimally perform the job with the specific advanced degree.”<sup>29</sup> Furthermore, “the basis for Air Force AAD-funded quota requirements are projected vacancies due to personnel rotations or new degree requirements.”<sup>30</sup> If the requirement for an AAD remains, the MAJCOM must revalidate it—otherwise, the AAD coding must be removed.<sup>31</sup>

When MAJCOMs determine that a degree requirement “cannot be filled by AFPC from the current inventory due to a lack of qualified candidates, the position requires a recent graduate as opposed to someone from the current inventory, or is a new career field requirement,”<sup>32</sup> they can request a “fresh” degree.<sup>33</sup> When filling out AF Form 1779, “USAF Advanced Academic Degree System (AADS) Position Worksheet,” one can justify the AAD quota request on the basis that only a “fresh” degree can “ensure state-of-the-art technology or research.”<sup>34</sup> Such a request “initiates a start in a graduate program that will fill your AAD-coded position upon graduation.”<sup>35</sup> Additionally, “the need for a ‘new’ degree should be made at the lowest possible level; i.e., supervisor with first-hand knowledge of what new degree, if any, is required to ensure

overall project/program success.”<sup>36</sup> Once the MAJCOMs provide their AAD requirements to AU/CFRS, they are forwarded to the Air Staff Career Field Managers (CFMs) for “review and validation.”<sup>37</sup>

There are several potential problems with this system of “bottom-up” justification for AAD positions. First, there is the difficulty involved with having a central authority arbitrate between competing priorities whose justification can hinge on the need for “cutting edge” capability that, as endorsed by AF 36-2302, can be most accurately judged by the bench-level supervisor with similar specialized expertise. Career field managers, while being qualified in the same general academic areas as the degree quotas they are defending, are nevertheless probably less qualified to validate needs than the first-level supervisors who generate the requests. Since the CFM must, in general, rely on the accuracy of the submitted quota requests, he/she can’t always provide an independent “validation” of the need. Furthermore, as representatives to the AFERB, there is a natural tendency to emphasize the needs of the career field one represents instead of making an unbiased appraisal in the context of the Air Force’s corporate needs. At least one observer at A1D has expressed concern regarding the possibly “rare and coincidental” alignment of career field interests with the “deliberate developmental goals” of the overall Air Force.<sup>38</sup> As a corporate entity made up of representatives of diverse academic disciplines, the AFERB working group is even less able than the individual CFMs to independently gauge the validity of individual AAD quota requests.

Another area of possible concern is the ability to justify quotas based on the need for a “fresh” (*i.e.*, recent) degree. One potential justification for a recent degreed would rely on the claim that research in science and technology is developing so rapidly that degrees earned years ago have furnished their holders with education that is now out of date. A research group at

AFRL, for example, staffed largely with civilian researchers, could campaign for a fresh degree quota for an officer billet in order to bring a recent PhD into the group. The officer's "fresh" degree could bring new ideas and capability into the group.

There is some merit to this concept. First, younger people tend to be more conversant with computer technology and the latest programming languages and techniques, having "grown up" with it from an early age. Second, the history of science has shown many examples in which young minds were able to make the intuitive leaps that led to major scientific breakthroughs. One notable example can be seen in Einstein's multiple revolutionary discoveries that he published in 1905 at the age of 25 (including his theory of special relativity).<sup>39</sup>

The idea that a university is the only place in which to acquire new knowledge or become familiar with the field's latest developments is flawed, however. Scientific conferences, professional journals, and collaborations with outside organizations all provide opportunities for established researchers to keep abreast of and contribute to modern research. Indeed, it is the full-time job of AFRL civilian researchers to maintain the currency of their skills and the relevance of their research.

Furthermore, the pace and scope of modern research is such that no one can reasonably hope to keep up with every important development outside of a very narrow specialty. Doctoral education, therefore, consists of mastering the fundamentals of a discipline and then acquiring (usually independently of formalized coursework) the specialized skills needed for a particular research thrust. As the body of scientific knowledge continues to expand, it becomes increasingly difficult to both master the broad fundamentals and become sufficiently specialized to make meaningful original research contributions. A recent degree isn't comparable to a

firmware update that ensures that one's electronics are using the latest, most complete set of software instructions.

In fact, recent doctoral recipients aren't typically immediately competitive for faculty positions in science and engineering—it has become a *de facto* requirement that faculty candidates in science and engineering complete several years of (usually poorly paid) post-doctoral research before applying for faculty positions. Most fundamental concepts are not rapidly evolving in fields like physics, chemistry, mathematics, and engineering, but have been around for decades (or even centuries). Anyone who has mastered these fundamentals can “get up to speed” as to the specifics of a particular research project or subfield as fast as a recent doctoral recipient—a recent graduate may even be at a disadvantage before completing a post-doctoral appointment. Given this context for the complexity of modern scientific research and the enormous time investment required in becoming sufficiently expert in a subfield in order to become effective at an advanced level, one can wonder as to the *real* reasons the hypothetical group of civilian AFRL researchers mentioned above would be so desirous of a “fresh” military doctoral recipient. In the absence of other controlling factors, the idea that a recent degree imbues its holder with mental powers denied those with dated degrees just isn't credible.

There are, of course, significant external factors influencing the professional competence of officer doctoral degree holders, including the assignments process and the Air Force's desire to simultaneously develop an officer as a researcher and as a military professional. One perennial feature of the assignments process for recent graduates is the “intervening tour” by which recent doctoral recipients earmarked for school in preparation for teaching are not immediately put into faculty positions at Air University (AU), AFIT, or the United States Air Force Academy, but rather assigned to jobs of a more martial character. The usual reasons offered for doing this

include the need to “re-blue” the candidates as military professionals after their years in the academic realm, as well as to develop the officer’s military service record to keep him/her competitive for promotion. Even in AFIT education programs with immediate AFRL follow-on jobs, the Air Force Personnel Center (AFPC) will make the effort to “broaden” the officer in a non-research job immediately following this payback tour.

It does not astonish, therefore, that an AFRL research group possessing a Field Grade Officer (FGO) billet would demand that it be filled by a recent graduate. An officer with an older degree will likely have spent much of his/her time since graduation in staff or leadership jobs, with a concomitant atrophy of their technical skills. A newly minted PhD could very well have a learning curve less steep than that of a “re-blued” FGO. Requests for quotas to send officers for recent degrees may indicate the Air Force is wasting its investment in previous degrees by allowing (even requiring) the holders of these degrees to lose their technical research relevance by serving in jobs not closely related to their education.

There are several different “flavors” of quotas that the AFERB considers for approval. First, there are “funded” and “user-funded” quotas. Tuition for the funded quotas is paid for out of the AFERB budget (the pot of money designated by the code AETC 84752 PEC)<sup>40</sup>. These quotas include “faculty prep” quotas (*e.g.*, those ‘pipeline’ slots whose graduates will serve on the faculties at AU/AFIT/USAF), intermediate developmental education (IDE) slots, and many “special programs” (to be defined below).<sup>41</sup> Tuition for user-funded quotas is not paid from the AFERB pot, but rather by an outside agency. Examples of user-funded programs are legal master’s programs paid for by SAF/JA, comptrollership degrees paid for by SAF/FM, or full scholarships or fellowships such as the Olmsted Fellows program for master’s-level studies abroad.<sup>42</sup>

In addition to their source of funding, quotas are also categorized according to whether or not they are matched to AAD-coded billets validated by the AFERB. Faculty prep and other “regular” quotas are matched against validated AAD billets. “Special” programs are not: “Most Special Program quotas are submitted by the Air Staff Functional to AU/CFRS, and compete for man years along with the Regular and Faculty Prep at the AFERB. However, some programs are Air Staff directed (fenced) for a specific number for a specific fiscal year.”<sup>43</sup> Being directed by the Air Staff does not mean that extra funding is provided for these mandated programs – the man years and tuition come out of the same limited pots used by other programs competing at the AFERB. Most special program quotas are for master’s programs, and have to contend with regular programs, both master’s and PhD, for man years and tuition monies. Examples of funded special programs include IDE programs in-residence at AFIT or NPS, legal master’s programs, chaplain degrees, and enlisted degrees at AFIT. User-funded special programs include some legal master’s degrees, senior developmental education (SDE) programs such as the Lean Aerospace Initiative (LAI), and the Olmsted Scholarship program.<sup>44</sup> The only PhD-level special degrees approved by the AFERB from fiscal year (FY) 2006 through FY 2009 were for degrees at AFIT and NPS with accompanying PME seminars (three total), as well as programs for newly commissioned USAFA graduates at the Pardee RAND Graduate School (13 total).<sup>45</sup>

The Chief of Staff of the Air Force (CSAF) Scholars program is a recent special degree program in which the General Schwartz has specifically directed the AFERB to set aside man years and tuition funding for “prestigious” degrees. For FY 2011, the AFERB will be designating three Master’s and three PhD quotas for attendance at schools such as Harvard, Tufts, and Princeton.<sup>46</sup> These degrees will generally be in subjects aimed at developing senior-level strategic thinkers, such as national security studies and international relations, and at schools

with which the Air Force (or other military services) have pre-existing “relationships.” One source of such relationships is the Air Force Fellows program,<sup>47</sup> in which the Air Force sponsors officers for research fellowships at schools and centers at prestigious universities (e.g., the Belfer Center of the John F. Kennedy School of Government at Harvard University).<sup>48</sup> It is one thing for the Air Force to pay for executive education and research fellowships at high-end schools—it is quite another to attempt to routinely produce PhDs in three years at institutions where the normal time-to-degree is in the range of seven to nine years. Perhaps these specific programs (with which the Air Force has established long-term relationships) will be more amenable to an accelerated doctoral program than the overall universities at which they reside.

The United States Air Force Academy (USAFA) is a major player across multiple categories of degree quotas: faculty preparation master’s degrees and PhDs, various funded and user-funded master’s programs (and a few PhDs) for recent graduates, and specially funded degrees for training staff. Faculty preparation quotas for the United States Air Force Academy represent the Air Force’s single largest block of regular PhD degree quotas, with 127 such degrees approved and filled from FY 2006 through FY 2009.<sup>49</sup> In addition to requesting these faculty pipeline degrees, USAFA also advocates for man years and tuition funding for degrees for its recent graduates. Three of such programs falling under the purview of the AFERB process are the National Competitive Scholarship Program (NSCP), the Endowed Scholarship Program (ESP), and the Graduate School Program (GSP). Under NSCP, graduating cadets are permitted to compete for and accept “international and national scholarships and fellowships, such as the Rhodes, Marshall, Truman, Fulbright, and Hertz Scholarships.”<sup>50</sup> Most of these programs represent a real savings to the Air Force, since tuition is provided for from private organizations external to the Air Force. Surprisingly, a subset of these NSCP “scholarships” is actually funded

by the Air Force. These quotas compete for tuition funds with other funded programs, apparently to support master's degrees at Harvard University.<sup>51,52</sup> The ESP program sponsors recent USAFA graduates using privately endowed scholarship funds established expressly for USAFA cadets. GSP quotas are fully funded by the Air Force, and “[allow] cadets who graduate in the top 25 percent of their class, based upon their Overall Performance Average (OPA), to pursue a twelve-month master's degree program.”<sup>53</sup> The intent behind the GSP program is for academic departments at USAFA to identify likely candidates among cadets for grooming as future faculty. Historically, the understanding that a cadet chosen for GSP will return at a later date to teach at USAFA has been an informal one. Recently, however, USAFA has instituted a tracking system to monitor (and hopefully increase) the rate of “payback” tour completion.<sup>54</sup>

A particular program of note at USAFA (known to the author from his time on the USAFA faculty) is the “Dean's Oxford Program,” which is not called out as a special program in the AFERB documentation available to the author, instead falling under the general “regular” quota categorization.<sup>55</sup> With a view to increasing the quality of the USAFA faculty, the Dean selects one or two individuals per year to earn a doctorate specifically at Oxford University. One could cynically argue that the true purpose of this program is to increase the *perceived* quality of the faculty; if true, even this can be defended as a valid goal. With the default justification for USAFA faculty preparation quotas being “accreditation” considerations,<sup>56</sup> the diversity and prestige of faculty degrees is a legitimate concern. Needless to say, the individuals lucky enough to be chosen for this program are eager to earn a prestigious degree in an exotic setting. One may wonder why this program is limited to Oxford—why not, for example, the “Dean's Harvard Program?”

One clue to this mystery is the time required to earn a doctoral degree at a civilian university. In the United States, the total time spent earning the doctorate for degree recipients in 2006 averaged 6.7 and 7.9 years in the physical and social sciences, respectively.<sup>57</sup> The figures for engineering and the humanities were 6.9 and 9.7 years, respectively.<sup>58</sup> Typical degree programs involved about two years of demanding coursework and qualifying examinations, followed by full-time research. In contrast, an Oxford DPhil is “research intensive” from the start, and “[lasts] 3-4 years.”<sup>59</sup> Programs at Oxford typically don’t have qualifying examinations and have very limited requirements for formal coursework, allowing students more time for research early in their programs.<sup>60</sup> Additionally, the ability to pay for tuition (either in full or a significant fraction) can make a candidate quite attractive at Oxford, where only 45 percent of students are “fully funded by scholarships or awards,”<sup>61</sup> as opposed to 70-95 percent of students at United States universities, depending on field of study.<sup>62</sup> Since most funding opportunities at Oxford are reserved for British/EU students and funding levels at American universities of prestige similar to that of Oxford are even higher than the general US average, one can surmise that an offer by the Air Force to pay tuition for any given program at Harvard would not play as significant a role in the admissions process for doctoral programs (though, in the author’s experience, money can be a significant factor for admissions at those US schools where funding is relatively scarce). It would be very difficult to count on Harvard (or other US schools of similar stature) to provide both reliable admission of candidates and timely graduations, especially across the range of departments and fields tapped by the Dean’s Oxford Program. It is unfortunate that, in order to provide a reliable source of “prestige” to the USAFA faculty, the Air Force has to not only pay for an expensive tuition (comparable to that at private US universities),<sup>63</sup> but also the cost of an overseas PCS and the (incredibly) high cost of housing in

the Oxford area. As discussed above, it will be interesting to monitor the time-to-degree and graduation rate of the new CSAF Scholars at schools like Harvard, Tufts, and Princeton. The long-term financial relationship with the Air Force may provide individual degree programs with the incentive to both routinely admit Air Force doctoral candidates and then allow them to graduate in less than half the time of their typical students, but it also might not.

USAFA's faculty preparation students overwhelmingly attend civilian institution schools for their doctoral programs. Only eight of 127 students (about six percent) sent for PhDs between FY 2006 and FY 2009 attended AFIT in residence.<sup>64</sup> This is interesting, since 41 percent of the USAFA faculty preparation quotas initially approved by the AFERB for FY 2010 were specifically for AFIT in-residence, based on the requested field of study.<sup>65</sup> One can infer that the majority of those slated for in-residence doctorates ultimately obtain approval from USAF/DPDE to attend civilian institutions. The need for degree diversity among the faculty at USAFA would be a valid and frequent reason to attend a civilian institution—many of the military faculty at USAFA already have master's degrees from AFIT.

Air University (AU) was approved for 78 faculty preparation PhD quotas from FY 2006 to FY 2009—AFIT accounted for 48 of these quotas.<sup>66</sup> Of the remaining 30 quotas, the breakdown was as follows: 43 percent for Air Command and Staff College (ACSC), 27 percent for the School of Advanced Air and Space Studies (SAASS), 20 percent for Air War College (AWC), seven percent for the Ira C. Eaker Center for Professional Development, and three percent for Squadron Officer College (SOC). The bulk of these degrees were in political science (43 percent) and history (23 percent), though information systems management and economics each made up 10 percent of the total. All of the doctoral programs for AU faculty preparation (other than students preparing to be on the AFIT faculty) were at civilian institutions. The

justifications for these positions sometimes show the competitive pressure felt by the requestors due to the vicissitudes of AFERB prioritizations from one year to the next, as well as the inherent difficulty of providing solid quantification of the consequences of a rejected request: “AWC normally gets two quotas, but had only one candidate for the past two years”, “in 1997, ACSC identified 12 positions that required AADs—in order to fill these ... ACSC needs to send four AAD candidates per year,” and “for maximum credibility, the Chair should be both an education professional as well as a uniformed officer.”<sup>67</sup>

About 17 percent of AFIT faculty preparation doctoral candidates were sent to earn their degrees at AFIT itself from FY 2006 to FY 2009. A number of these positions have as a justification that a “fresh degree [is] required to bring rapidly changing state-of-the-art technology to AFIT students.”<sup>68</sup> In light of the earlier discussion on the likely benefits of a “fresh degree,” one could question the validity of this justification, since (on the surface) it seems to be somewhat circular: the candidate needs to attend AFIT, where he/she will obtain skills the AFIT faculty currently lacks. In reality, as discussed above, students as well as faculty have resources outside the school itself for acquiring new knowledge and skills. Nevertheless, AFIT (like USAFA) needs to beware of over-inbreeding its faculty by sponsoring too many degrees at Air Force schools.

In contrast to the faculty preparation quotas for USAFA, AFIT, and AU PME schools, 78 percent of the active-duty doctoral candidates sent by the Air Force under a “regular” quota from FY 2006 to FY 2009 attended AFIT in-residence or its sister school, the Naval Postgraduate School (NPS).<sup>69</sup> Under an agreement made between the Air Force and the Navy, both services send their students to the AFIT or NPS for any subjects taught there, nominally using civilian institutions only when the desired degree is not available at Wright-Patterson AFB or

Monterey.<sup>70</sup> Of the 22 percent of these non-faculty preparation quotas assigned to civilian schools, about one-third of them are in support of the National Reconnaissance Office (NRO). Many of the academic fields in this category of non-faculty-preparation-quotas-at-civilian-institutions are clearly not subjects taught at AFIT (*e.g.*, chemistry, toxicology, political science). In short, one can conclude that attendance at civilian institutions is extremely rare in practice as well as in policy for non-faculty preparation quotas if: 1) the Air Force is funding the tuition and 2) the requested degree is offered at AFIT or NPS.

It is important to realize that, with the exception of user-funded programs, all of the degree sponsorship categories discussed above, from USAFA faculty prep to the CSAF Scholar's program, are in direct competition with each other for tuition money and man years; furthermore, even the "user-funded" programs require man years from the AFERB. This being the case, the creation of the CSAF Scholars program, the expansion of enrollment in IDE/SDE programs, or a PhD program at SAASS (currently in the planning stages<sup>71</sup>) requires either an increase in the overall AFERB budget or a reduction in the number of sponsorships for other degree programs. Understanding this point helps to explain why apparently beneficial programs sometimes lose their funding. One notable example in recent years is the Scholarship/Fellowship/Grant program formerly overseen by AFIT/CI, which allowed officers to compete for and accept external scholarships for graduate school, to include research assistantships. The AFERB no longer allocates man years to this program,<sup>72</sup> which provided degrees from top-tier institutions at no tuition cost to the Air Force. Absent an organizational advocate for these miscellaneous fellowships (these quotas were not attached to any specific AAD-coded billets), costlier programs now take precedence with respect to man years. Another casualty in recent years has been number of USAFA GSP quotas, of which 26 were filled in

2006, 13 in 2007, 5 in 2008, and two in 2009.<sup>73</sup> This reduction will have an impact on future school sponsorship quotas, since 41 percent of projected USAFA faculty pipeline returnees in 2011, for example, were sponsored by the GSP program.<sup>74</sup> Robbing Peter to pay Paul now could lead to USAFA having a need for more faculty prep master's quotas in the coming years. This, in turn, will put pressure on quota availability for other degree programs, including PhD sponsorships. In recognition of this fact, and supported by the new GSP graduate tracking system mentioned above, the AFERB reinstated 20 GSP quotas for FY 2011.<sup>75</sup>

*Air Force budgeting for PhD sponsorships*

USAF/A1M programs student man years as part of the Students, Transients, and Personnel Holdee (STP) account, which is used to “budget for individuals not available for assignment into operational units.”<sup>76</sup> These man years nevertheless count against Air Force end strength. With nine percent of total active-duty end strength falling under STP and officers accounting for eight percent of STP<sup>77</sup> and 19.8 percent of the active duty force,<sup>78</sup> one can estimate that about 3.6 percent of the officer corps is accounted for by student man years at any one time. Student man years apply not only to those in full-time graduate school or PME, but to anyone “attending training greater than 20 weeks in a PCS status;”<sup>79</sup> hence, the number of officers in full-time graduate programs will be lower than 3.6 percent, and well below the congressionally mandated level: “At no time shall more than 8 per centum of the authorized commissioned officer strength ... be detailed as students ... at such technical, professional or other civilian educational institutions ... as shall be best suited to enable such personnel to acquire knowledge or experience in the specialties in which it is deemed necessary that such personnel shall perfect themselves.”<sup>80</sup>

USAF/A1M crafts its initial STP plans based on prior and current year student man year levels. When the AFERB requires an increase in student man years beyond this level, there are two options: either the CSAF can mandate that A1M provide the man years or, failing such top cover, the AFERB must route its request through the regular Program Objective Document (POM) cycle, where it competes for funding with other Air Force priorities.<sup>81</sup> Tuition and student man years are paid from Program Element (PE) 84752.<sup>82</sup> An officer student man year is budgeted at a flat rate of \$137,000, regardless of rank (and hence, regardless of actual cost for a specific individual).<sup>83</sup>

### **Recent history of Air Force PhD sponsorships at civilian institutions**

What should the Air Force look for in a civilian doctoral program? As the ultimate beneficiary of the education received by its officers, the Air Force has multiple factors to consider. Among these are quality, perceived quality (*i.e.*, prestige), access (ease of admission), average completion time, success rate, and diversity of programs. Additionally, for the usual case of the Air Force paying tuition, cost is an important consideration. Often, these factors are interrelated; for example, access may decrease as program quality increases. By examining data on Air Force officer doctoral programs at civilian institutions for the last nine years<sup>84</sup> (including programs with completion dates from early 2001 through October of 2009), the following discussion will consider how well the Air Force is meeting its educational needs.

#### *Quality/perceived quality*

It is difficult to quantify the quality of an educational program. As noted above, one's post-degree job performance is heavily influenced by one's pre-degree character and habits, making the specific effect of education difficult to distinguish. There *are* quantifiable qualities within graduate programs, however. Considerations such as faculty funding, frequency and

quality of faculty publications (as judged by citations and journal “impact factors”), major laboratory facilities, and library holdings all can be reasonably expected to influence the quality of the educational experience of a student. Annual ranking of educational programs use such factors to rate schools and individual degree programs.<sup>85</sup> Furthermore, the *perceived* quality of a program can affect its *actual* quality. Programs with strong reputations attract more admissions candidates, permitting departments to be more selective in building their student body. Classes composed of highly talented students permit educators to delve more deeply into a broader range of material, and to hold students to higher standards of performance both in the classroom and in research. In graduate school, where having more talented students can equate to an increased ability to win research grants, the most talented faculty gravitate toward schools with the most demanding admissions standards. This “snowball” effect can have a significant influence on program quality. As Braxton writes, “the folklore of higher education ... holds that institutions with more selective admissions have higher academic standards and thus higher quality academic programs ... such folklore is not without some empirical support.”<sup>86</sup>

The link between perceived quality and actual quality of graduate programs is not the only reason for caring about perceived quality. In some cases, the Air Force may actually require perceived quality as a primary consideration. The Air Force can benefit from the credibility that comes from having officers with graduate degrees from top programs. To appreciate this point, one has simply to look at the press coverage of GEN David Petraeus, which constantly trumpets his Princeton doctorate as a reason to respect his views.<sup>87</sup> Would they be as excited about how smart they think he is were his degree from a lesser-known school? As mentioned above, this point is obviously not lost on the current Air Force Chief of Staff.

This study will not attempt to distinguish between actual quality and perceived quality, but will rely on program and school rankings published by US News & World Report.<sup>88</sup> These rankings of graduate programs and graduate schools are of both the specific field (*e.g.*, civil engineering) and the broad field (the overall ranking of the engineering school). The US News ranking of undergraduate programs<sup>89</sup> is also of interest, since rankings of graduate programs taken in isolation can be potentially very misleading. Graduate education can be extremely specialized, and a program well ranked in (for example) information systems management does not necessarily have top-flight faculty and students as the specialized ranking would suggest. Some fields, especially new “interdisciplinary” ones, are offered only at a small number of institutions--some of these programs are created with the express purpose of trying to stand out. Additionally, the nature of some programs (again, often in newly fabricated fields), attracts a demographic that is less interested in the hard-core rigor of more established (or simply more difficult or demanding) disciplines. On the other hand, some universities genuinely cultivate highly rigorous programs in niche subfields, and staff them with top quality faculty. It is also important to recognize the US News ranking of sub-fields is not as comprehensive as their other ranking categories, and some programs are likely to have slipped through the cracks. By considering the subfield ranking in the context of the overall graduate school rankings (engineering/social science/humanities/science) and the undergraduate rankings of the institution, one can better understand what the program ranking says about the likely quality and competitiveness of the program.

To provide a broad description of the quality/perceived quality of Air Force civilian institution doctoral programs, I will begin by considering institutional quality as measured by undergraduate rankings. Out of 496 doctoral program assignments in the last nine years, 20 of

them (four percent) have been to institutions ranked within the top 10 nationally. Fifty-seven of them (11 percent) were to top-30 institutions (including those in the top 10). On the other end of the spectrum, 14 percent of officers attended doctoral programs at “Tier 3” and “Tier 4” institutions—those bottom-half schools to which US News does not assign a numerical rank. An additional 13 percent of officers attended doctoral programs at schools not considered by US News at all for their undergraduate programs. Many of these unranked programs (40 percent) were foreign schools, but others were specialized US graduate schools such as the Pardee Rand Graduate school (14 attendees) and the Naval Postgraduate School (22 attendees).

The US News rankings for graduate schools and specific graduate programs are split into far more categories than the undergraduate rankings. With each division into more categories, the numerical rankings for each program are biased towards lower (better) numerical rankings, since fewer universities belong to a specific category. I will begin the consideration of graduate program quality by considering the broad field rankings from US News, where “broad field” means such divisions as engineering, business, mathematics, political science, history, English, psychology, chemistry, and sociology. Eight percent of Air Force officer doctoral programs had top-10 rankings by broad field, with 25 percent having a top-30 ranking. On the other hand, 26 percent of programs attended by officers were not ranked by US News, even though an appropriate ranking category existed. Only eight percent of the graduate programs were considered “unrankable,” being foreign schools or programs for which no suitable broad category existed within the US News structure.

For many programs, the US News rankings are compiled by specialty. Instead of the engineering school ranking, for example, one can look at the specific ranking of the *electrical* engineering program. Other examples of specialties include international relations (instead of

political science), logistics (in lieu of business), and statistics (instead of mathematics). This further parsing by category leads to a greater bias toward better rankings, but also causes fewer schools to be ranked at all, since the rankings by specialty are necessarily less comprehensive those of broader categories. Ten percent of Air Force officer doctoral candidates attended top-10 programs as ranked by specialty, with 27 percent of officers attending top-30 programs. Thirty-seven percent enrolled in unranked (by specialty) doctoral programs, and 17 percent attended programs that were “unrankable” as defined above. Interestingly, the Air Force Institute of Technology’s aeronautical engineering graduate program is ranked at #32 by US News.

Whether or not the numbers presented above are satisfactory is a matter of opinion, and depends upon what the Air Force sets as goals for its doctoral programs. If subject matter competence is the main goal, then perhaps the Air Force should focus on reducing the number of students attending bottom-tier schools that are unranked by field or specialty. If “window dressing” for Air Force credibility is a goal, then one should focus on increasing the numbers of students attending top-ranked schools (by undergraduate ranking—the surest measure of “name recognition,” since few are familiar with graduate specialty rankings). Of course, there are reasons the numbers are what they are: access, completion rates, and cost. With a reminder to the reader that the changes in Air Force practice proposed by this paper would greatly widen Air Force options with respect to all three of these factors, the discussion will now consider the available data for the last 10 years with regards to completion rates.

#### *Completion rates/times*

Overall, 69 percent of Air Force officers sent to earn doctoral degrees in the last nine years did so within the allotted time frame (this includes approved extensions). Of those completing their degree on time, 18 percent took longer than three years, with the longest

permitted time being four years. An additional 13 percent of AFIT/CI doctoral candidates completed their degrees after being reassigned from school. About 38 percent of these students received an extension (of at least one month) past the nominal three-year program limit—several of these candidates enjoyed 6 months or more extra time. Finally, 18 percent of Air Force officer doctoral candidates failed to obtain a degree (presumably—AFIT’s data on students that complete their degrees after leaving school is limited to self-reporting, something an officer would probably do out of concern for his/her career). All but one of these candidates spent at least two and one-half years in school, and about a quarter of them spent more than a month past the nominal three years in school. Six of them were permitted to stay in school past three and one-half years—interestingly, all of these candidates were studying math, engineering, or the physical sciences. Perhaps these technical degree candidates had more persuasive reasons for requesting an extension (*e.g.*, equipment arriving or one last experiment/computer simulation to run) than those with less concretely focused research.

Credibility may also be influenced by track record—technical degree candidates had a higher on-time completion rate (75 percent) than non-technical candidates (61 percent). Similarly, a higher percentage of those pursuing non-technical degrees failed to obtain a degree (22 percent) than their technical counterparts (14 percent). The fraction of non-technical candidates completing their degrees late (after leaving school) was also higher (17 percent) than for technical degree candidates (10 percent). These are not surprising results—they mirror the data (provided previously) on completion time for technical vs. non-technical degree candidates at civilian universities. The average time for program completion for Air Force officer doctoral programs initiated between 1998 and 2006 has held steady right around the three year mark, with no discernable change over these years. Of course, this average is constrained by the truncation

of some programs at the originally scheduled three-year point, even when the candidates had not yet earned a degree.

*Diversity*

Over the last nine years, the Air Force has sent officer doctoral candidates to a fairly diverse group of schools: 31 private institutions, 13 international universities, and 81 public universities. There is good geographic diversity, with schools from all regions of the country. Significant “clustering” is evident in the data, where an unusual number of degree candidates attend the same school for the same subject. One notable example is the Rochester Institute of Technology (RIT), where 13 students have earned doctorates in imaging science. It is noteworthy that all 13 students attending RIT graduated with a degree at the end of their allotted time, though three of them were accorded an extra half year (beyond the nominal three). Many of these students are sent to RIT after a highly competitive selection process by the NRO. This may partly explain the unusual 100 percent success rate of students there, but one could argue that students admitted by top-10 schools such as Princeton, Yale, MIT, Chicago, and Duke are probably also very talented. Only 50 percent of students attending these schools, however, completed their degrees on time (an overly grim statistic—half of the remainder either completed their degrees *in absentia* or are currently working on doing so). The unusual success rate at RIT may also be related to the school’s special relationship with the NRO, the intelligence community, and the military. By gearing its programs to Air Force needs and then relying on the Air Force to send funded students, RIT’s imaging science program becomes dependent on the good will of the Air Force. If its programs fail to produce on-time graduates, RIT’s bottom line could suffer. It is also possible that research funding at RIT is indirectly influenced by the attendance of Air Force candidates. Without wishing to imply anything unsavory, it is obvious

that RIT's imaging science program would be a magnet for funding from government agencies if a critical mass of students (several of them sponsored by the NRO) there were working on militarily relevant research. This source of (fully funded) students could dry up if students routinely failed to graduate.

Other clusters are evident in the data, probably generated by geographical proximity to the sponsoring organization (a large number of Academy faculty preparation candidates attend the Colorado School of Mines, Colorado State University or the University of Colorado) or by successful Air Force precedent (*e.g.*, candidates sent for math degrees to North Carolina State University in successive years). Some other specialty programs seem to cater to Air Force needs. One example is the Solar and Space Science program at Utah State University, which boasts a 100 percent graduation rate for the five Air Force candidates who have attended in the last nine years. In contrast, of the fourteen officers who left the Pardee RAND Graduate School (PRGS) between 2003 and 2009, four of them did so without degrees. It seems that reliance on federal funding has not incentivized the PRGS faculty to take it easy on Air Force officers. Similarly, Air Force candidates at the Naval Postgraduate School (NPS) enjoyed an average success rate, with three of 22 students failing to earn a degree--all but one of these candidates studied in a technical field, so this success rate is spot-on the overall Air Force officer average.

The sponsorship categories of Air Force doctoral programs over the last nine years are shown in Table 1. Faculty preparation accounts for 79 percent of all civilian institution doctoral sponsorships, with the Air Force Academy using the lion's share of these quotas. "Regular" quotas (approved by the AFERB in response to Air Force needs in places such as the Air Force Research Laboratory) seem somewhat misnamed, given that they account for less than one in six of Air Force-sponsored doctoral programs at civilian schools. Of the degrees allowed under the

scholarship/fellowship program, over a quarter of them were for the Pardee RAND Graduate School.

**Table 1** Air Force officer civilian institution doctoral programs by sponsorship category for programs with completion dates from 2001-2009.<sup>90</sup>

<i><b>SPONSORSHIP CATEGORY</b></i>	<i><b>%</b></i>
Faculty Prep - USAFA	46
Faculty Prep - AFIT	22
Faculty Prep - AU	11
Regular	15
Scholarship/Fellowship	5
Developmental Education (PME)	< 1
Information Assurance Scholar	< 1

**Table 2** Air Force officer civilian institution doctoral programs by sponsorship category for programs with completion dates from 2001-2009.<sup>91</sup>

<i><b>FIELD OF DEGREE</b></i>	<i><b>%</b></i>
Social Sciences	25
Engineering	21
Physical Sciences	17
Management	11
Mathematics	9
Humanities	8
Computer Science/Information Technology	6
Biological Sciences	2
Medical	1

Table 2 displays the distribution among disciplines for Air Force doctoral programs sponsored at civilian institutions. Overall, technical fields and non-technical fields account for 55 percent and 45 percent of the sponsored degrees, respectively. Among regular degree quotas,

however, 85 percent of the programs were in technical fields. This gross inequality is offset with a slim majority of non-technical programs among the faculty preparation quotas. To summarize, it appears that 1) the Air Force's main justification for sponsoring non-AFIT doctoral degrees is for faculty preparation and 2) the Air Force does not see much need for sponsoring non-technical doctoral degrees other than for instructor preparation.

**Proposed improvements to Air Force PhD sponsorship**

Relying to a greater extent on external funding for Air Force doctoral candidates and allowing the direct pursuit of doctoral degrees (bypassing the master's degree where possible) could benefit the Air Force in several ways. First, the Air Force could realize cost savings. Second, the Air Force could increase the overall quality of the education received by its officers. Third, completion rates could be improved. Let us consider all three of these possible benefits in turn, before discussing the implications of these changes for the Air Force's selection of degree candidates and the potential risks of these policy changes.

*Cost savings*

The average cost for tuition for civilian institution programs has been estimated to be about \$16,500 for FY 2010.<sup>92</sup> This estimate seems reasonable, assuming the Air Force pays in-state tuition at state schools. According to the College Board, the average in-state tuition at public four-year universities averaged \$7,020, with the average for private schools being \$26,273 (graduate tuition is usually comparable to undergraduate tuition, though sometimes fractionally higher).<sup>93</sup> With a man year budgeted at \$137,000, it would require about eight officers to win scholarships in order to generate enough savings to produce an additional man year for the AFERB. If every officer attending a civilian institution over the last nine years had used external funds rather than having their tuition paid for by the Air Force, it would have saved the Air Force

over 23 million dollars. Viewed another way, this would have saved about 19 man-years per annum, or six additional PhD quotas (at three years each) per year. This represents about a 10 percent savings for civilian institution doctoral sponsorships.

While significant, this 10 percent savings would not, in and of itself, be a “game changer,” since civilian institution doctoral programs use only a fraction of the overall AFERB-allotted man years (Air Force-sponsored master’s degrees require a number of man years comparable to that used by doctoral degrees).<sup>94</sup> However, there are also opportunity costs that could be saved by using external funding. Currently, the Air Force “caps” the maximum tuition it will pay at a civilian institution at \$19,000 per year (in most circumstances—this is more a guideline to keep costs within budget than a fast rule).<sup>95</sup> This is well below the average cost of private universities, and is a major factor in limiting the Air Force’s choice of universities, in turn limiting the quality of the education it makes available to its officers. Were the Air Force to use external tuition monies, tuition cost would no longer be a factor in determining where students may attend. Using these external funds should not present any insurmountable legal or ethical challenges, since there is extensive precedent in the use of such funds (e.g., the National Competitive Scholarship Program for recent USAFA graduates).

In order to put Air Force officers on a more equitable footing with their civilian peers in competing for external funds, the Air Force will need to make adjustments to its paradigm for scheduling a degree in an officer’s career. The Air Force currently separates the master’s and doctoral programs into discrete units, imposing intervening assignments and putting a three-year time limit on doctoral studies. This is largely unacceptable to the main source of external funds for graduate school: advisors who can offer research assistantships. Research assistantships are generally funded from the research grant money controlled by individual faculty members.

Renewal of such research grants hinges on the quality and quantity of research results. Since graduate students are often the primary workhorses on research projects, faculty members are often dependent on the qualifications and dedication of their graduate students for the success of their research and their ability to attract continued funding. Furthermore, a graduate student's time of greatest research productivity is typically during the years after they have completed their coursework and qualifying examinations—not only can they devote themselves full-time to research, but they have already had the time to become intimately familiar with a given research problem and mastered the “basics” of the theoretical/experimental techniques involved in attacking it. Since a typical doctoral program involves about two years of full-time coursework and qualifying exams, an Air Force officer having only one year past this period is not likely to be as productive in their research as a civilian graduate student who can offer several dedicated years of work. If the Air Force is to routinely use research assistantships as a source for external funding for PhD programs, doctoral programs must be lengthened—happily, this will not require a lengthening of the overall time an officer spends in graduate school if the Air Force would encourage officers to bypass separate master's degrees or simply earn the master's degree *en passant*. Many top departments increasingly view the master's degree as either unnecessary<sup>96</sup> or primarily as a consolation prize for a failed attempt at a doctorate.<sup>97</sup> Some simply do not offer a master's degree at all.<sup>98</sup>

### *Quality of Education*

Combining the typical one and one-half years and three years for a master's and doctoral degree (respectively) into a single four and one-half-year program would not merely make officers more competitive for research assistantships. It would also make them more competitive for admission to more competitive programs. This is largely for the same reasons (discussed

above) that longer program limits would increase a student's ability to attract funding from advisors, since graduate admissions decisions are made by individual departments. These decisions are heavily influenced by potential advisors looking for strong candidates. Easing the admission of officers into more competitive institutions would improve Air Force academic credibility and competence by reducing the number of students attending bottom-tier schools, as well as raising the number of officers that study in top-tier programs. A single four and one-half-year program would not require more total man years than earning an 18-month master's and then a three-year doctorate.

*Completion rate*

In addition to opening the door to both admissions and funding at top institutions, a four and one-half-year doctoral program could increase the graduation rate of AFIT civilian institution programs. The 69 percent on-time completion rate of Air Force officers is fairly good. Using data from a study of 10 universities, one can infer an average completion rate in civilian doctoral programs of about 56 percent.<sup>99</sup> Considering that successful Air Force students are required to graduate in half the time of their peers, this number is even more impressive. For proper perspective, however, one must recognize that military officers are probably more disciplined, focused, driven, and supported than many of their civilian counterparts—the need to get done on time or risk ruining one's career can be a powerful motivation, and officers receiving their full military salary have fewer financial complications to deal with than the typical graduate student. By allowing a more reasonable time in which to complete one's studies, the Air Force could raise this completion rate even higher. The 18 percent of Air Force candidates who do not report ever earning their doctoral degrees represent an unnecessary waste of resources.

A program of study leading directly to the PhD (from a bachelor's degree) also offers another risk-reducing factor, namely, that of not having to start over at a second institution. Course requirements for a doctorate at one school can be different from those taken for a master's degree at a different school, and precious research time can be lost to coursework that would not have been needed had the student remained at one institution. Additionally, one is more likely to succeed at qualifying examinations when one hasn't had several years of mental atrophy—this is especially a factor in disciplines requiring mathematics, where one truly must “use it or lose it.” Finally, working on one continuous research project permits greater depth of inquiry, and is more likely to result in an acceptable doctoral thesis.

The increased use of research assistantships may, in and of itself, lead to a greater chance of successful graduation. The majority of students in physical science and engineering receive primary support from research assistantships, and these technical fields enjoy a shorter mean time-to-degree than non-technical fields.<sup>100</sup> These assistantships are typically given by one's faculty advisor, using money the advisor receives from a research grant. The advisor is required to make regular reports to the funding agency (be it governmental or industrial) on the progress of the research, and possibilities of future funding are heavily dependent on the research results. This being the case, the advisor is highly motivated to see positive progress in the student's research. While a student may be primarily responsible for one aspect of a research project, post-doctoral researchers, fellow graduate students, undergraduates, and the faculty advisor are often directly involved with related aspects of the overall project, and dependent (both intellectually and financially) themselves on the student's results. With such interdependencies, a student will not often be permitted to languish alone in unfruitful research or laziness. Reliance on the research assistantship, therefore, may also explain the observation that “the Natural Sciences

tend to lose their students early, while other divisions continue to lose students even after a decade of study.”<sup>101</sup>

### *Selection of candidates*

To maximize the benefits of using external funding for tuition, the Air Force will have to change its mindset of “if the Air Force is sending you to school to fill an Air Force requirement, the Air Force is obligated to pay your tuition” to one of “the Air Force will give sponsorship priority to officers who can secure external funding for tuition.” The view that graduate education is simply an advanced form of externally imposed “tech training” is too narrow—not only should graduate school serve a broader role in expanding one’s intellectual horizons, but the individual officer has a strong personal interest in both what and where he/she is to study: “since this advanced education benefits individuals by increasing their lifetime earnings potential, it should at the very least be possible to shift part of the cost of training to the individual.”<sup>102</sup> Instead of allowing officers to accept external funding on a cases-by-case basis, the Air Force should publish a list of acceptable sources of external money (this list must include research assistantships, the primary source of funds available), and encourage any officers who desire to attend graduate school to compete for these funds. Only where requirements cannot be met through externally funded applicants should the Air Force pay tuition—it should be recognized, however, that students unable to secure external sponsorship likely have academic qualifications below the average of their civilian competitors, most of which are successful at securing fellowships and assistantships.

### *Risks*

There are several potential risks involved with the lengthening of the doctoral program. Two important ones involve retention of PhDs and the impact of the prolonged educational

interruption to an officer's career. With current Air Force practice, an officer can be "strung along" by a sequential series of training commitments. Serving three years payback for a master's degree before beginning doctoral studies, then serving the five-year additional commitment after earning the doctorate ensures the retention of officers in whom the Air Force has made a large investment. A four and one-half-year interruption to an officer's military career, depending on the timing, could have potentially disastrous effects on promotion potential.

As far as retention is concerned, current regulation on active duty service commitments (ADSCs) would ensure that officers completing a four and one-half year PhD using external funding would have an obligation to stay into the service well beyond the critical 10-year threshold. According to AFI 36-2107, completion of a graduate program funded by a scholarship, fellowship, or grant carries an ADSC of three years for every one year of school.<sup>103</sup> This stands in stark counterintuitive contrast to Air Force-funded programs for which the "payback" is capped at five years for a doctoral program.<sup>104</sup> Officers who begin an externally funded PhD program in their first year as a second lieutenant and complete their program in four and one-half years would not be eligible to separate until the 18-year point. Under this construct, there would be no "flight risk" for allowing early schooling.

Of course, this lengthy commitment is also risky for the Air Force, which may wish to "try before it buys." Does the Air Force really want to commit to retaining a junior officer for 18 years before seeing how they perform in their military duties? This risk could be mitigated by sending first lieutenants and junior captains who have had the chance to prove their superior military performance.

Sending officers for their doctoral studies as early as possible would also minimize the negative career impact of the lengthy interruption. Promotion to captain is automatic and the

promotion rate to major is so high that promotion risk would be minimal for even junior captains sent for a four and one-half-year doctoral program. Sending a major for such an extended absence, however, could deprive him/her of vital mid-career assignments that would enhance promotion potential.

There are other reasons that early schooling is advantageous. First, the Air Force would have earlier and lengthier use of PhDs if officers earn these degrees as lieutenants and captains. Second, significant cost savings (even more than those from using external funds for tuition) could be realized by paying the salaries of lieutenants and captains as compared to the current system where many of the sponsored students are majors and lieutenant colonels.

### **Conclusion**

Overall, Air Force officers are doing an admirable job of earning doctoral degrees at civilian universities. They earn degrees in a variety of technical and non-technical fields from a large group of universities that is geographically diverse and within which every level of quality and prestige is represented. Additionally, the Air Force's 69 percent on-time completion rate (not to mention the 82 percent of its candidates who eventually earn their doctorates) far exceeds the typical graduation rate found at civilian universities. Their success is a testament to the quality of the candidates the Air Force chooses for degree sponsorship at civilian schools, as well as the remarkable financial support (full salary with virtually all expenses paid) the candidates receive from the Air Force.

In certain respects, however, these candidates succeed in spite of the limitations the Air Force puts upon them. The Air Force tuition cap, enforced in most cases, severely limits the range of schools available to individual officers and prevents the Air Force from ensuring that officers are attending the best and most appropriate programs possible. Even more problematic

are the antiquated practices of requiring a separate master's degree, requiring intervening assignments between master's and doctoral programs, and limiting doctoral programs to three years. These practices are out of step with current practice at civilian institutions, and handicap Air Force students in multiple ways. First, the three year time constraint makes Air Force students much less attractive to advisors who wish to invest effort in students who have the time to perform significant research. This affects both admissions decisions and offers of external financial support. Second, the quality of an Air Force degree candidates' education is negatively affected by the short time they have to perform original research.

This short time (possibly as little as one dedicated year after required coursework and qualifying exams) can be further infringed upon by the need to take refresher courses and do supplemental study after a break in schooling. Taking these factors into account, students have to carefully choose programs that will accommodate these unusual constraints, weighing the risks of academic failure and not finishing their research on time. These factors contribute to the number of lower quality institutions selected by some Air Force candidates—depending on their individual talents and circumstances, they may not have sufficient time to complete sufficient original research while playing academic catch-up at a challenging school. It is also obvious that the depth and breadth of possible research (and hence, its educational worth) is also constrained by the time limit. Air Force candidates have about one year available for full-time research, as compared to the five to seven years typically used by their civilian counterparts—a ridiculous discrepancy. Though the author was not permitted access to data on Air Force student qualifications, the high graduation rate of Air Force doctoral candidates, despite the limitations placed upon them, testifies to their quality and shrewd choices of doctoral programs.

By rethinking the three-year time limit and the requirement of a separate master's degree, the Air Force could raise the overall level of the programs its officers attend, as well as the educational benefit officers receive from those programs. By adopting the civilian model of a continuous bachelor's-to-doctoral degree program, the Air Force could establish four and one-half years as the time baseline for doctoral studies. In addition to opening up higher-end programs to many more students, this would make Air Force officers competitive for the research assistantships and other external funds used by the majority of graduate students at US universities. Using these external funds for tuition would also result in a significant cost savings, enough to pay for 19 additional school man years per annum.

In summary, Air Force sponsorship of doctoral degrees at civilian universities is remarkably successful at producing graduates, given its self-imposed constraints. Nevertheless, limiting doctoral programs to three years and paying tuition from Air Force coffers reduces educational quality and incurs needless costs. By adapting to the realities of civilian graduate education, the Air Force could significantly increase the effectiveness and efficiency of its educational programs.

## Endnotes

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- <sup>1</sup> Thomas B. Hoffer et al., *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates* (Chicago, IL: National Opinion Research Center, 2007), 81-82.
- <sup>2</sup> Teresa D. Dearth, "FY11 AAD AFERB CFRS Briefing," 16 September 2009, 9.
- <sup>3</sup> Thomas B. Hoffer et al., *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates* (Chicago, IL: National Opinion Research Center, 2007), 78.
- <sup>4</sup> *Ibid.*, 75.
- <sup>5</sup> Gary S. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition* (New York, NY: Columbia University Press, 1975).
- <sup>6</sup> N. A. Barr, *Higher Education Funding* (London: LSE Research Online, 2004), 7, <http://eprints.lse.ac.uk/archive/00000288>.
- <sup>7</sup> *Ibid.*
- <sup>8</sup> Gary S. Becker, *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition* (New York, NY: Columbia University Press, 1975), 11, 18.
- <sup>9</sup> Federico Garcia, Jeremy Arkes, and Robert Trost, "Does employer-financed general training pay? Evidence from the US Navy," *Economics of Education Review* 21, no. 1 (February 2002): 19-27.
- <sup>10</sup> Marcella V. Powers, "A Survey of Studies Addressing Graduate Education in the United States Air Force," Research Report (Maxwell AFB, AL: Air War College, 1987), 46.
- <sup>11</sup> John N. Taylor, *Graduate Education of Air Force Line Officers*, Research Report no. AFHRL-TR-70-7 (Lackland AFB, TX: Personnel Research Division, 1970), 3.
- <sup>12</sup> Allan V. Burman, "An Evaluation of Fully Funded Graduate Education in the Armed Services" (PhD diss., The George Washington University, 1983), 40.
- <sup>13</sup> *Ibid.*
- <sup>14</sup> John N. Taylor, *Graduate Education of Air Force Line Officers*, Research Report no. AFHRL-TR-70-7 (Lackland AFB, TX: Personnel Research Division, 1970), 3.
- <sup>15</sup> Maxie McFarland, "Military Cultural Education," *Military Review* 85 (March-April 2005): 62-69.
- <sup>16</sup> Glen Spivey (Air Command and Staff College), interview by the author, 2 Sep 2009.
- <sup>17</sup> Robert A. Vitas, "Civilian Graduate Education and the Professional Officer," *Military Review* 79, no. 3 (May-June 1999): 47-58.
- <sup>18</sup> *Ibid.*, 53.
- <sup>19</sup> *Ibid.*
- <sup>20</sup> *Ibid.*, 54.
- <sup>21</sup> Air Force Institute of Technology, "Graduate Education," <http://www.afit.edu/grad.cfm>.
- <sup>22</sup> Clarence W. Hannon et al., "Graduate Education within the Armed Forces," Group Research Project (Carlisle Barracks, PA: Army War College, 1974), 156.
- <sup>23</sup> Air Force Institute of Technology, "AFIT Faculty Directory," <http://www.afit.edu/directory/Directory.cfm>.
- <sup>24</sup> Clark L. Allred, "Taking Advantage of External Funding for Air Force Officer Ph.D. Candidates at Civilian Universities," research paper, Air Command and Staff College, Maxwell AFB, AL, December 2009.
- <sup>25</sup> Air Force Instruction (AFI) 36-2302, *Professional Development (Advanced Academic Degrees and Professional Continuing Education)*, 11 July 2001.
- <sup>26</sup> *Ibid.*, 3-5.
- <sup>27</sup> *Ibid.*, 4.
- <sup>28</sup> *Ibid.*, 3.
- <sup>29</sup> *Ibid.*
- <sup>30</sup> *Ibid.*
- <sup>31</sup> Teresa D. Dearth, "F11 Advanced Academic Degree (AAD) Datacall Process," Talking Paper, 6 April 2009, 1.
- <sup>32</sup> *Ibid.*
- <sup>33</sup> Air Force Instruction (AFI) 36-2302, *Professional Development (Advanced Academic Degrees and Professional Continuing Education)*, 11 July 2001,, 5.
- <sup>34</sup> *Ibid.*, 34.

- <sup>35</sup> Ibid., 33.
- <sup>36</sup> Ibid., 34.
- <sup>37</sup> Teresa D. Dearth, "F11 Advanced Academic Degree (AAD) Datacall Process," Talking Paper, 6 April 2009, 2.
- <sup>38</sup> Michael K Sukach, HQ USAF/A1DLE, Pentagon, to the author, e-mail 15 Jan 2010.
- <sup>39</sup> Nobel Foundation, "Albert Einstein Biography," [http://nobelprize.org/nobel\\_prizes/physics/laureates/1921/einstein-bio.html](http://nobelprize.org/nobel_prizes/physics/laureates/1921/einstein-bio.html) (accessed 12 February 2010).
- <sup>40</sup> Teresa D. Dearth, "FY11 AAD AFERB CFRS Briefing," 16 September 2009, 7.
- <sup>41</sup> Ibid., 9.
- <sup>42</sup> Ibid.
- <sup>43</sup> Ibid., 7.
- <sup>44</sup> Ibid., 10.
- <sup>45</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>46</sup> Michael K Sukach, HQ USAF/A1DLE, Pentagon, interview by the author, 24 February 2010.
- <sup>47</sup> Air University, "Air Force Fellows," <http://www.au.af.mil/au/awc/fellows/listplus.htm> (accessed 24 February 2010).
- <sup>48</sup> Harvard University, "Belfer Center," <http://belfercenter.ksg.harvard.edu/fellowships/index.html> (accessed 24 February 2010).
- <sup>49</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>50</sup> United States Air Force Academy, "Graduate Studies Program Office," [www.usafa.edu/df/dfr/grad\\_studies/grad\\_studies.cfm](http://www.usafa.edu/df/dfr/grad_studies/grad_studies.cfm) (accessed 12 Feb 2010).
- <sup>51</sup> Teresa D. Dearth, "FY11 AAD AFERB CFRS Briefing," 16 September 2009, 10.
- <sup>52</sup> Joseph M. McDade, AF/A1D Force Development Director, to AETC/CC and USAFA/CC, spreadsheet attachment to draft memorandum, 2008.
- <sup>53</sup> United States Air Force Academy, "Graduate Studies Program Office," [www.usafa.edu/df/dfr/grad\\_studies/grad\\_studies.cfm](http://www.usafa.edu/df/dfr/grad_studies/grad_studies.cfm) (accessed 12 Feb 2010).
- <sup>54</sup> Larry H. Johnson, USAFA Director of Military Resources, to the author, email 13 April 2010.
- <sup>55</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>56</sup> Ibid.
- <sup>57</sup> Thomas B. Hoffer et al., *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates* (Chicago, IL: National Opinion Research Center, 2007), 78.
- <sup>58</sup> Ibid.
- <sup>59</sup> University of Oxford, "International Students," [http://www.ox.ac.uk/admissions/international\\_students/index.html](http://www.ox.ac.uk/admissions/international_students/index.html) (accessed 15 February 2010).
- <sup>60</sup> Shawn Willis, Air Force Oxford doctoral student, to the author, e-mail 28 May 2008.
- <sup>61</sup> University of Oxford, "International Students," [http://www.ox.ac.uk/admissions/international\\_students/index.html](http://www.ox.ac.uk/admissions/international_students/index.html) (accessed 15 February 2010).
- <sup>62</sup> Thomas B. Hoffer et al., *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates* (Chicago, IL: National Opinion Research Center, 2007), 81-82.
- <sup>63</sup> University of Oxford, "Oxford Fees Calculator," <http://www2.admin.ox.ac.uk/studentfunding/fees/coursefees.php5> (accessed 15 February 2010).
- <sup>64</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>65</sup> Joseph M. McDade, AF/A1D Force Development Director, to AETC/CC and USAFA/CC, spreadsheet attachment to draft memorandum, 2008.
- <sup>66</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>67</sup> Ibid.
- <sup>68</sup> Ibid.
- <sup>69</sup> Ibid.
- <sup>70</sup> Timothy R. Gaffney, "AFIT Benefits from Services 'Alliance'," Dayton Daily News, 20 December 2002, <http://afit-aog.org/NPS-AFIT.html> (accessed 20 November 2009).
- <sup>71</sup> Glen Spivey (Air Command and Staff College), interview by the author, 2 Sep 2009.
- <sup>72</sup> Luke Whitney (AFIT/CI program administrator), in discussion with the author, 9 September 2009.

- 
- <sup>73</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>74</sup> Larry H. Johnson, "USAF/DF PhD workbook," Excel spreadsheet, 22 January 2009.
- <sup>75</sup> Teresa D. Dearth, AU/CFRS and AFERB coordinator at AU, to the author, email 19 April 2010.
- <sup>76</sup> AF/A1MP, "Students, Transients, and Personnel Holdee (STP) Brief," 15 January 2009.
- <sup>77</sup> Ibid.
- <sup>78</sup> Air Force Personnel Center, "Air Force Personnel Statistics," <http://www.afpc.randolph.af.mil/demographics/reportSearch.asp> (accessed 24 February 2010).
- <sup>79</sup> AF/A1MP, "Students, Transients, and Personnel Holdee (STP) Brief," 15 January 2009.
- <sup>80</sup> *Act of June 4, 1920, Statutes at Large* 41 (1920): 127(a), 227, in Allan V. Burman, "An Evaluation of Fully Funded Graduate Education in the Armed Services," PhD diss., The George Washington University, 1983, 20.
- <sup>81</sup> Maritzel Castrellone (SAF/A1M staff officer), interview with the author, 24 February 2010.
- <sup>82</sup> Teresa D. Dearth (AU/CFRS and AFERB coordinator at AU), interview by the author, 4 December 2009.
- <sup>83</sup> Michael K Sukach, HQ USAF/A1DLE, Pentagon, to the author, e-mail 15 Jan 2010.
- <sup>84</sup> Luke D. Whitney, "AFIT/CIG History," Database-generated spreadsheet. 6 January 2009.
- <sup>85</sup> US News and World Report, "America's Best Graduate Schools," premium online edition, <http://premium.usnews.com/best-graduate-schools> (accessed 20 January 2010).
- <sup>86</sup> John M. Braxton and Robert C. Nordvall, "Selective Liberal Arts Colleges: Higher Quality as well as Higher Prestige?" *The Journal of Higher Education* 56, no. 5 (Sep-Oct 1985): 538-554.
- <sup>87</sup> Greg Jaffe, "Obama Wanted a Petraeus. Buyer Beware," *The Washington Post*, 11 October 2009, <http://www.washingtonpost.com/wp-dyn/content/article/2009/10/09/AR2009100902568.html> (accessed 9 December 2009).
- <sup>88</sup> US News and World Report, "America's Best Graduate Schools," premium online edition, <http://premium.usnews.com/best-graduate-schools> (accessed 20 January 2010).
- <sup>89</sup> US News and World Report, "America's Best Colleges," <http://colleges.usnews.rankingsandreviews.com/best-colleges> (accessed 20 January 2010).
- <sup>90</sup> Luke D. Whitney, "AFIT/CIG History," Database-generated spreadsheet. 6 January 2009.
- <sup>91</sup> Ibid.
- <sup>92</sup> Teresa D. Dearth (AU/CFRS and AFERB coordinator at AU), interview by the author, 4 December 2009.
- <sup>93</sup> College Board, "Economic Challenges Lead to Lower Non-tuition Revenues and Higher Prices at Colleges and Universities," <http://www.collegeboard.com/press/releases/208962.html> (accessed 24 March 2010).
- <sup>94</sup> Teresa D. Dearth, FY06-FY09 Approved and Filled Quotas, database-generated spreadsheet, 25 January 2009.
- <sup>95</sup> Luke Whitney (AFIT/CI program administrator), in discussion with the author, 9 September 2009.
- <sup>96</sup> Massachusetts Institute of Technology, "Political Science Frequently Asked Questions," <http://web.mit.edu/polisci/grad/faq.html> (assessed 25 November 2009).
- <sup>97</sup> Massachusetts Institute of Technology, "Physics Doctoral Guidelines," <http://web.mit.edu/physics/graduate/current/curdocguide.html> (assessed 25 November 2009).
- <sup>98</sup> Harvard University, "Government Graduate Program," [http://www.gsas.harvard.edu/programs\\_of\\_study/government.php](http://www.gsas.harvard.edu/programs_of_study/government.php) (assessed 25 November 2009).
- <sup>99</sup> Ibid., 22.
- <sup>100</sup> Thomas B. Hoffer et al., *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates* (Chicago, IL: National Opinion Research Center, 2007), 78.
- <sup>101</sup> Ad Hoc Panel on Graduate Attrition Advisory Committee, *The Path to the PhD: Measuring Graduate Attrition in the Sciences and Humanities* (Washington, D.C.: National Research Council, 1996), 20.
- <sup>102</sup> Eric A. Hanushek, "The Volunteer Military and the Rest of the Iceberg," *Policy Sciences* 8 (1977): 343-361.
- <sup>103</sup> Air Force Instruction (AFI) 36-2107, *Active Duty Service Commitments (ADSC)*, 22 April 2005, 7.
- <sup>104</sup> Ibid.

## Bibliography

*Act of June 4, 1920. Statutes at Large 41 (1920): 127(a), 227.* In Burman, Allan V. “An Evaluation of Fully Funded Graduate Education in the Armed Services.” PhD diss., The George Washington University, 1983.

Ad Hoc Panel on Graduate Attrition Advisory Committee. *The Path to the Ph.D.: Measuring Graduate Attrition in the Sciences and Humanities*, Washington, D.C.: National Research Council, 1996.

AF/A1MP. “Students, Transients, and Personnel Holdee (STP) Brief.” 15 January 2009.

AF/A1D. “FY10 AAD AFERB Working Group Quota Allocation Plan.” 2008.

Air Force Institute of Technology. “AFIT Faculty Directory.”  
<http://www.afit.edu/directory/Directory.cfm> .

Air Force Institute of Technology. “AFIT History.” <http://www.afit.edu/about.cfm?a=history>.

Air Force Institute of Technology. “Graduate Education.” <http://www.afit.edu/grad.cfm> .

Air Force Institute of Technology. *Graduate School of Engineering and Management 2009-2010 Graduate Catalog*. <http://www.afit.edu/en/docs/AFIT%20Graduate%20Catalog.pdf> (accessed 11 November 2009).

Air Force Institute of Technology. “Admissions FAQs.”  
<http://www.afit.edu/En/admissions/officeinfo.cfm?a=faqs>.

Air Force Instruction (AFI) 36-2009. *Delay in Active Duty for AFROTC Graduates*, 1 June 1999.

Air Force Instruction (AFI) 36-2107. *Active Duty Service Commitments (ADSC)*, 22 April 2005.

Air Force Instruction (AFI) 36-2213. *Support of Air University (AU) Education Program Personnel Attending Civilian Institutions by Air Force Reserve Officer Training Corps (AFROTC) Detachments*, 12 July 2006.

Air Force Instruction (AFI) 36-2301. *Professional Military Education*, 26 September 2007.

Air Force Instruction (AFI) 36-2302. *Professional Development (Advanced Academic Degrees and Professional Continuing Education)*, 11 July 2001.

Air Force Instruction (AFI) 36-2305. *Educational Classification and Coding Procedures*, 1 March 2001.

Air Force Instruction (AFI) 36-2306. *The Education Services Program*, 16 October 2000.

Air Force Personnel Center. "Air Force Personnel Statistics."  
<http://www.afpc.randolph.af.mil/demographics/reportSearch.asp> (accessed 24 February 2010).

Air University. "Air Force Fellows." <http://www.au.af.mil/au/awc/fellows/listplus.htm> (accessed 24 February 2010).

Air University Instruction (AUI) 36-2306. *Air University Educational Program Review*, 24 September 2007.

Allred, Clark L. "Taking Advantage of External Funding for Air Force Officer Ph.D. Candidates at Civilian Universities." Research paper, Air Command and Staff College. Maxwell AFB, AL, December 2009.

Becker, Gary S. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education, Second Edition*. New York, NY: Columbia University Press, 1975.

Braxton, John M. and Robert C. Nordvall. "Selective Liberal Arts Colleges: Higher Quality as well as Higher Prestige?" *The Journal of Higher Education* 56, no. 5 (Sep-Oct 1985): 538-554.

Dearth, Teresa D. "FY11 AAD AFERB CFRS Briefing." 16 September 09.

Dearth, Teresa D. FY06-FY09 Approved and Filled Quotas. Database-generated spreadsheet. 25 January 2009.

Dearth, Teresa D. F11 AAD Field Requests for CFM Review JUN09(61s and 62s). Jun 2009.

Dearth, Teresa D. "F11 Advanced Academic Degree (AAD) Datacall Process." Talking Paper, 6 April 2009.

College Board. "Economic Challenges Lead to Lower Non-tuition Revenues and Higher Prices at Colleges and Universities." <http://www.collegeboard.com/press/releases/208962.html> (accessed 24 March 2010).

Cubero, Ruben A. "The Attainment of a Doctoral Degree Relative to Other Variables in the Promotability of United States Air Force Academy Graduates to the Rank of Colonel." PhD diss., University of Denver, 1983.

Department of Defense Instruction 1322.06. *Fellowships, Scholarships, Training With Industry (TWI), and Grants for DoD Personnel*, 15 November 2007.

Department of Defense Instruction 1322.10. *Policy on Graduate Education for Military Officers*, 29 April 2008.

Department of Defense Instruction 1322.25. *Voluntary Education Programs*, 5 February 1997.

Downing, Jonathan G. "United States Air Force Graduate Degrees from 1990 to 2000: A Comparison." Master's thesis, Air Force Institute of Technology, 2001.

Drew, Dennis M. "Educating Air Force Officers: Observations after 20 Years at Air University." *Airpower Journal* 11, no. 2 (Summer 1997): 37-45.  
<http://www.au.af.mil/au/cadre/aspj/airchronicles/apj/apj97/sum97/drew.pdf> (accessed 11 Oct 2009).

Educational Testing Service. "General Test Percentage Distribution of Scores Within Intended Broad Graduate Major Field." [http://www.ets.org/Media/Tests/GRE/pdf/5\\_01738\\_table\\_4.pdf](http://www.ets.org/Media/Tests/GRE/pdf/5_01738_table_4.pdf).

Educational Testing Service. "GRE Guide to the Use of Scores." <http://www.ets.org/gre>.

Ferrer de Valero, Yaritza. "Departmental Factors Affecting Time-to-Degree and Completion Rates of Doctoral Students at One Land-Grant Research Institution." *The Journal of Higher Education* 72, no. 3 (May-June 2001): 341-367.

Gaffney, Timothy R. "AFIT Benefits from Services 'Alliance'." *Dayton Daily News*, 20 December 2002.

Groves, Kenneth J. "Air University and the Professional Education System." *Air University Review*, July-August 1975.  
<http://www.airpower.au.af.mil/airchronicles/aureview/1975/jul-aug/groves.html> (assessed 11 Oct 2009).

Hanushek, Eric A. "The Volunteer Military and the Rest of the Iceberg." *Policy Sciences* 8 (1977): 343-361.

Harvard University. "Belfer Center." <http://belfercenter.ksg.harvard.edu/fellowships/index.html> (accessed 24 February 2010).

Harvard University. "Government Graduate Program." [http://www.gsas.harvard.edu/programs\\_of\\_study/government.php](http://www.gsas.harvard.edu/programs_of_study/government.php) (assessed 25 November 2009).

Hoffer, Thomas B., Mary Hess, Vincent Welch, and Kimberly Williams. *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates*. Chicago, IL: National Opinion Research Center, 2007.

Hoskins, Thomas E. "The Effects of Perceived Overqualification on Job Satisfaction, Organizational Commitment, and Turnover: A Study of AFIT Graduates." Master's thesis, Air Force Institute of Technology, 2003.

Jaffe, Greg. "Obama Wanted a Petraeus. Buyer Beware." *The Washington Post*, 11 October 2009.

<http://www.washingtonpost.com/wpdyn/content/article/2009/10/09/AR2009100902568.html> (accessed 9 December 2009).

Johnson, Larry H. "USAFA/DF PhD workbook." Excel spreadsheet. 22 January 2009.

Lavin, Kenneth A. Record of 2003 graduate school-bound USAFA graduates. 13 January 2009.

McDade, Joseph M. AF/A1D Force Development Director. To AETC/CC and USAFA/CC. Draft memorandum, 2008.

Merrill, Stephen A. *Trends in Federal Support of Research and Graduate Education*. Washington, D.C.: National Research Council Committee on Trends in Federal Spending on Scientific and Engineering Research: Board on Science, Technology and Economic Policy, 2001.

Massachusetts Institute of Technology. "Political Science Frequently Asked Questions." <http://web.mit.edu/polisci/grad/faq.html> (assessed 25 November 2009).

Massachusetts Institute of Technology. "Physics Doctoral Guidelines." <http://web.mit.edu/physics/graduate/current/curdocguide.html> (assessed 25 November 2009).

Nobel Foundation. "Albert Einstein Biography." [http://nobelprize.org/nobel\\_prizes/physics/laureates/1921/einstein-bio.html](http://nobelprize.org/nobel_prizes/physics/laureates/1921/einstein-bio.html) (accessed 12 February 2010).

Powers, Marcella V. "A Survey of Studies Addressing Graduate Education in the United States Air Force." Research Report. Maxwell AFB, AL: Air War College, 1987.

Sanderson, Allen R., Bernard Dugoni, Thomas Hoffer, and Lance Selfa. *Doctorate Recipients from United States Universities: Summary Report. Survey of Earned Doctorates*. Chicago, IL: National Opinion Research Center, 1999.

Sny, Daniel R. "A Validity Study on the Air Force Institute of Technology Student Selection Criteria for Resident Master's Degree Programs." Master's thesis, Air Force Institute of Technology, 1991.

Sukach, Michael K., AF/A1DL POC to the AFERB. To the author. Email, 15 January 2009.

United States Air Force Academy. "Graduate Studies Program Office." [www.usafa.edu/df/dfr/grad\\_studies/grad\\_studies.cfm](http://www.usafa.edu/df/dfr/grad_studies/grad_studies.cfm) (accessed 12 February 2010).

University of Oxford. "International Students." [http://www.ox.ac.uk/admissions/international\\_students/index.html](http://www.ox.ac.uk/admissions/international_students/index.html) (accessed 15 February 2010).

University of Oxford. "Oxford Fees Calculator."  
<http://www2.admin.ox.ac.uk/studentfunding/fees/coursefees.php5> (accessed 15 February 2010).

US News and World Report. "America's Best Colleges."  
<http://colleges.usnews.rankingsandreviews.com/best-colleges> (accessed 20 January 2010).

US News and World Report. "America's Best Graduate Schools." Premium online edition.  
<http://premium.usnews.com/best-graduate-schools> (accessed 20 January 2010).

Vitas, Robert A. "Civilian Graduate Education and the Professional Officer." *Military Review* 79, no. 3 (May-June 1999): 47-58.

Whitney, Luke D. "AFIT/CIG History." Database-generated spreadsheet. 6 January 2009.

Willis, Shawn. Air Force Oxford doctoral student. To the author. E-mail 28 May 2008.