Final Report

External Review of the Operations Research Department of the Naval Postgraduate School

March 27, 2017

Submitted by:

Dr. Richard Burke, Deputy Director of Cost Assessment in the Office of the Secretary of Defense, Cost Assessment and Program Evaluation (CAPE)

Dr. John P. Lehoczky, Thomas Lord University Professor of Statistics and Mathematical Sciences at Carnegie Mellon University (CMU)

Dr. Stephen Robinson, Professor Emeritus, University of Wisconsin – Madison; Member, National Academy of Engineering
Table of Contents

1 Introduction ................................................................. 3
2 Present state of the OR Department ............................... 3
   2.1 Need to strengthen faculty ....................................... 4
   2.2 Hiring regulations not faced by competing institutions ........................................................................ 4
   2.3 Need for more administrative support and less extreme compliance ................................................. 5
   2.4 Need for a disciplinary strategic plan .......................... 5
3 Threats to the OR Department .......................................... 5
   3.1 Decrease in Size of the OR Department: Need to Hire to Required Strength ............................... 5
   3.2 Over-Regulation ....................................................... 6
      3.2.1 Some examples of over-regulation ....................................................................................... 7
      3.2.2 Further comments on over-regulation ................................................................................. 9
   3.3 Need for a good strategic plan ...................................... 9
4 Review of curriculum ........................................................ 9
   4.1 Resident masters programs ........................................ 10
   4.2 Distance learning (DL) masters programs .................. 12
      4.2.1 Background ......................................................... 12
      4.2.2 RC findings on distance learning ....................................................................................... 12
      4.2.3 Importance of DL programs .............................................................................................. 13
      4.2.4 Opportunities for NPS in DL programs ............................................................................... 14
   4.3 New Developments in Education .................................. 14
5 Summary of Conclusions/Recommendations ..................... 15
1 Introduction

Dr. Steven R. Lerman, Provost and Academic Dean of the Naval Postgraduate School (NPS), established an external committee to review the Department of Operations Research (OR), one of four academic departments in the Graduate School of Operational and Information Sciences (GSOIS). The last such review was conducted in 2001. The review committee (RC) was provided with a set of documents including a two-part report prepared by the OR Department in July, 2016; Part 1: Self-Study Report and Part 2: Strategic Assessment and Plan accompanied by extensive appendices. The RC requested and received additional documentation including the 2001 Review Committee Report and a set of curriculum reviews provided by Navy sponsors including:

- Joint Operational Logistics (361)
- Systems Engineering Analysis (308)
- DL Systems Analysis (363)
- DL Master of Cost Estimating and Analysis (379)

Provost Lerman charged the RC to provide a general analysis of the OR education and research programs both for their quality and their relevance to the US Navy. The programs were to be compared with their counterparts in civilian universities with special attention paid to aspects that made them unique. Finally, the RC was charged to address the characteristics and outputs of the programs, the faculty, the support staff and other resources provided as well as the OR Department’s interactions with Navy sponsors.

The RC visited the OR Department on February 27-28. This visit included extensive discussions of the educational and research programs with OR Department faculty and students as well as the senior leadership of NPS. The RC appreciates very much the help and cooperation provided by members of the OR Department as well as members of the NPS administration. This made our task much easier. In addition, the careful notes prepared by Captain Tiffany Stillwell, USA, were of great help to us in preparing this report.

2 Present state of the OR Department

The NPS OR Department has been and is still the unquestioned leader in military OR. Furthermore, this department is widely known for its work in the broader category of applied OR. This reputation is supported by a very strong faculty, which as recently as five years ago contained three members of the National Academy of Engineering (G. Brown, D. Gaver and A. Washburn), six winners of the INFORMS J. Steinhardt Prize for outstanding contributions to Military OR (J. Borsting, G. Brown, D. Gaver, W. Hughes, D. Schrady, and A. Washburn), nine winners of the INFORMS Koopmans Prize for the best paper in military OR (G. Brown, W. M. Carlyle, R. Dell, M. Kress, T. Lucas, P. Sanchez, S. Sanchez, R. Szechtman, and A. Washburn),
one winner of the INFORMS President’s Award (G. Brown), along with many other awards from important professional societies.

A particular distinction arrived in 2013, when the NPS OR Department was the second academic department to be awarded the INFORMS UPS George D. Smith Prize. This prize is awarded “to an academic department or program for effective and innovative preparation of students to be good practitioners of operations research, management science, or analytics.” Finally, a periodic assessment of applied OR programs in the US known as the “Rothkopf Report” is made and published in the INFORMS journal *Interfaces*. The rankings are based on publications in *Interfaces* and the practice section of *Operations Research*. The eleventh instance of this report appeared in July 2016. The NPS OR Department has consistently appeared among the top three ranked departments, and it is cited along with MIT for this consistency of performance. All of these accolades clearly show that the NPS OR Department has been the outstanding department in military OR and a top national department in applied OR.

Although in the recent past the OR Department has had enormous impact on the practice of OR and the military, especially the Navy, through its research and educational programs, its ability to sustain that impact is very much in jeopardy: in effect, the department is nearing the edge of a cliff. There are four reasons for great concern:

### 2.1 Need to strengthen faculty

The faculty is aging, and a number of the faculty stars have retired (e.g. Gaver and Washburn) with others toward the ends of their careers. The faculty currently does consist of some prominent senior individuals and some quite promising junior faculty, but the faculty size has been significantly diminished over the last five years, especially the tenure track faculty and the research faculty. The reduction in faculty size is the result of retirements, departures, an NPS-wide hiring freeze, and reductions in research funding. This diminution of faculty strength means that the department is stretched to perform its educational mission, and the research mission has been curtailed. Unless immediate steps are taken to increase the size of the faculty, the NPS OR Department will not be able to sustain the remarkable impact it has had on the Navy and DoD or on the practice of OR more generally.

### 2.2 Hiring regulations not faced by competing institutions

For several years, the NPS OR Department was not allowed to hire to fill vacant slots because of a hiring freeze. When the department was able to hire, there have been serious impediments (e.g. inability to advertise positions in important journals and the inability to have a booth at major conferences) that reduce the visibility of the positions to prospective applicants. This is in addition to structural problems in which the NPS can only hire faculty who can receive a security clearance, something which severely limits the population eligible to fill their positions, and which adds long delays before an offer can be made. In the past, the OR Department has benefited greatly from the National
Research Council (NRC) Postdoctoral Program. This program has brought talented postdoctoral scholars to the department, a significant number of whom have joined the faculty. The funding of this program crosses fiscal years, which in the past was easily handled through the use of interim accounts. Unfortunately, interim accounts have been disallowed by NPS, thus eliminating this excellent source of bringing talent to the NPS OR department.

2.3 Need for more administrative support and less extreme compliance
The OR Department is in desperate need of additional administrative support. Several years ago the department had two administrative staff members, but this has been reduced to one. As a result, many administrative tasks must be performed by the faculty themselves. Not only do the faculty lack the expertise and experience to carry out these tasks efficiently, but also these administrative activities take away from the time that the faculty could be spending on their research and department educational programs. Moreover, faculty face severe and seemingly unwarranted regulations and long delays until issues are resolved. Some examples are provided in Section 3.2.1 below.

2.4 Need for a disciplinary strategic plan
The OR Department needs to make a serious study of its current capabilities in the disciplines it represents (which it characterizes as its four “pillars”: statistics, stochastics, simulation and optimization), the way in which these pillar disciplines have evolved over the recent period, and the role of these pillars in the mission of the Navy and DoD. One obvious example is statistics. Over the last five years there have been major developments in the field with the infusion of machine learning concepts. The new methodological developments along with the great increase in the magnitude and types of data sets that are being addressed (loosely referred to as “data science” and “big data”) need to be infused in the OR educational programs as well as the research programs. The OR Department’s strategic plan does not address these issues, and such considerations should be taken into account in any hiring plan.

Each of these is further discussed in the next section of this report.

3 Threats to the OR Department
In this section we provide more detail on the threats faced by the OR Department and provide some recommendations.

3.1 Decrease in Size of the OR Department: Need to Hire to Required Strength
Over the five-year period from 2011 to 2016, the numbers of OR personnel in various faculty categories changed as follows (figures provided by Vice Provost Moses in an email of 27 February 2017):
Tenure track faculty: from 23 to 20;
Research faculty: from 8 to 2;
Senior lecturers or lecturers: from 14 to 13;
Faculty associates: from 11 to 5;
Military faculty: from 9 to 8.

Thus, within a five-year period the department went from having 65 people in the faculty categories to having 48: in terms of percent it lost 26% of its total faculty personnel, including 75% of its research faculty and 55% of its faculty associates.

No department could take such a cut without serious negative effects on its output unless a quarter of its previous faculty effort had been unproductive. In view of the achievements and honors recited at the beginning of Section 2, that certainly was not the case with respect to the OR Department. There have, in fact, been serious negative effects.

First, as stated in Section 2.1, this diminution of faculty strength means that the department is stretched to perform its educational mission, and the research mission has been curtailed. Both of these are serious losses when one considers the very high standing and the important contributions of this department before the cuts began.

However, these are not the only negative effects. As explained in Section 4.2.2, there is tension between the Resident programs and the Distance Learning programs, and one substantial contributor to this tension appears to be the fact that the OR faculty has suffered a significant drop in their faculty size and is hard pressed to take on the extra burdens of distance programs. This appears to us to have contributed to the formation of an internal view within the OR Department that is completely resource-constrained, and zero-sum in nature. One of the steps needed if the OR Department is to recover the capability that it has had in the past is an increase in the size of the faculty, not only to the level that it had in 2011 but actually to a higher level, because of new requirements, such as distance learning programs, that did not exist in 2011. The hiring goals necessary to achieve such an increase should be determined by the departmental strategic plan, when it is formulated, and this is one of many reasons why the development of a strong strategic plan should be a high priority for the OR Department. Also, in order to make the hiring effort succeed NPS will need to remove the serious obstacles to successful hiring that now exist, such as those described in Section 3.2.1.

### 3.2 Over-Regulation

Current policies and practices of the NPS non-academic administration appear to be reducing the effectiveness of the OR Department in several ways. The RC heard of multiple instances in which rather than supporting the work of the OR faculty, in fact the policies were constraining
the department faculty in counterproductive ways. These constraints generally are of two types: (1) declining to allow the faculty to do things that in the view of the RC should be permitted, and (2) taking exorbitant amounts of time to process straightforward requests. The latter part of this section gives some examples that were reported to the committee by OR faculty members.

Before turning to those specific examples, it is important to make two general points on the topic of over-regulation. First, it should be noted that the RC study focused exclusively on the OR Department; however, there is no reason to believe that the OR Department is in any way unique with respect to these constraints. Second, the RC also is aware that a 2012 Navy Inspector General’s report found serious lapses in administrative procedures at NPS. This report led to major changes in the NPS administration and extreme attention being paid to a very strict interpretation of administrative policies and procedures. Some of these policies are instituted at the DoD level and some are at the NPS level. The RC is not suggesting that policies be ignored. Rather it is suggesting that the NPS academic administration work closely with the NPS non-academic administration (e.g. Legal, Contracts, Finance, and Purchasing). The academic administration needs to ensure that the non-academic administration fully understands the unique mission of the NPS and the damage some of the policies that were reported to the RC are causing in compromising the NPS mission. The non-academic administration must understand that the NPS must compete for faculty against major universities. Given the constrained salary structure and the requirement for US citizenship, NPS already faces an uphill battle. Additional constraints serve to worsen an already difficult challenge. On the other hand, it is equally important for the non-academic administration to explain the rationale behind the policies to the academic administration, so that they can, in turn, explain to the faculty why any particular rule exists and must be enforced. Through a dialog, it is possible that the NPS could reach a less-regulated state, but one that is still compliant with the rules and policies of the Navy and the DoD. Such a result would both increase the effectiveness of the NPS in achieving its DoD mission and increase the morale of the faculty.

3.2.1 Some examples of over-regulation

- Several senior OR faculty members have been principal investigators on a National Research Council (NRC) postdoctoral program. This program has been unusually productive for the OR Department as over the years it has brought a series of excellent scholars to the department. Moreover, a significant number of those scholars have stayed and joined the OR faculty. Now, due to financial regulations that important recruiting tool has essentially been lost. The reason has simply to do with a mismatch in the flow of postdoctoral funds across fiscal years. Due to the way in which Congress provides money to DoD, if a person is recruited for an appointment to begin in the autumn it is sometimes the case that no funds will be available to NPS to support that hire until several months later. NPS is not allowed to hire such a person without the funds being in place to support the hire. This problem
of timing is not new, and previously it was handled by faculty members’ use of interim accounts to support the postdoc until current fiscal year money arrived. Such interim accounts have now been forbidden, and so unless other external sources of funding can be found, the hiring of the postdoctoral scholar is not possible. Given the highly productive history of this NRC Postdoctoral Program for the OR Department, the present situation is highly detrimental (not to mention dispiriting) to the department faculty. The RC believes that this is an administrative situation that can certainly be solved, and we urge that this be done immediately so that further time is not lost.

- Uncertainty about the number, type and level of available faculty positions currently makes hiring infeasible. The RC asked about the specific hiring plans; however, it was apparent that this was not yet known. Academic hiring planning begins early each fall, so at this point, the OR Department has lost this year’s hiring cycle. Even if slots were available, the OR Department appears to be unable to publicize the opportunities, because it is forbidden to pay for advertisements in professional publications, and so can only get its message out by using online listservs not requiring payment, or by word of mouth. This puts the department at an obvious disadvantage in recruiting against academic, industry, and other organizations vying for top talent. Accordingly, the OR Department has no effective way of getting out its message. As a contrast, one member of the RC is currently chairing a hiring effort. His home institution provided a list of twelve publications where advertisements must be placed, and it is very likely that many more will be purchased in other publications.

- Another serious impediment to hiring is the inability of the OR Department to buy a table at the recruiting event held at the very large annual meeting of the Institute for Operations Research and the Management Sciences (INFORMS), which typically attracts around five thousand attendees. This annual meeting normally takes place in October or November, and by then it is unlikely that money for that fiscal year will have arrived.

- The most recent recruiting attempts have yielded pitifully small cohorts of desirable candidates—five, for example, in one effort—while a strong research university would expect to get at least a hundred applicants for such a position. This is a very dangerous indicator for the department and for NPS. In such a situation it is counterproductive to continue constraining the recruiting function in the ways cited above. Moreover, we were told that it takes approximately six weeks to get a hiring request approved. The people being recruited are of high quality and are likely to have attractive offers from other universities or companies. They are very unlikely to be willing to wait six weeks for an approval that in fact may never come.

- Many faculty expressed frustration because of apparently unreasonable administrative decisions. For example, one faculty member, who had research funds that required
travel, wanted to purchase some small cloth bags in which to keep pencils and similar small items, used in the research, secure during travel. The administration asked why these were needed, and upon hearing the explanation pronounced that the bags could not be purchased because the Naval Postgraduate School was not authorized to buy luggage.

### 3.2.2 Further comments on over-regulation

The administration is supposed to be at NPS in order to support the work of the academic departments that produce the products—instruction and research—that are the reasons why NPS exists. The committee heard from many faculty members that the effect of many of the administrative actions is just the opposite: they constrain the department and lower its level of activity. Three units that were named repeatedly were the contracting office, the purchasing office, and the legal office.

It should be kept in mind that difficulties reported to us, such as the above examples, occurred over the last five years. Consequently, the particular administrators who created the difficulties cited here may not still be in place. However, the clear message from the faculty was that the system as it is now does not work.

### 3.3 Need for a good strategic plan

Even if the recruiting difficulties cited under section 3.2.1 did not exist, the department would still face challenges in recruiting because it does not appear to have a clear idea of the research directions that it will follow in the future. A very effective way for departments to attack that question is for them to develop and put into action a good strategic plan. In the process of writing such a plan it is necessary to face the facts that no department can do everything, and that consequently it is necessary to decide what the department will emphasize and what it will not.

At NPS, the OR Department knows best its own capabilities, the recent evolution of the four pillar fields and the OR needs of the Navy and DoD. It can do these assessments on its own. We strongly recommend that the department begin the process as soon as it is able. Nevertheless, a good departmental strategic plan must be informed by and consistent with the strategic objectives of NPS. Furthermore, some of the areas, like data science and cyber-security are inherently interdisciplinary and may cross college boundaries. We do not know whether GSOIS or NPS themselves have strategic plans, but if not then we recommend that they develop them, as those plans will provide important input to the strategic plans of the individual departments, like OR.

### 4 Review of curriculum

Provost Lerman’s charge asked the RC to review the educational programs with an emphasis on their quality, their uniqueness compared with programs offered by civilian universities and their value to the Navy and DoD. The RC focused exclusively on the Resident and Distance Masters
Programs. The RC was provided with detailed curricula for each of these programs along with the latest periodic evaluations of those conducted by the sponsoring organization. In addition, the RC received briefings on the resident and the distance programs. Finally, the RC had a one hour session in which the finalists in the Tisdale competition presented their thesis research. During its visit, the RC had a luncheon meeting with 10 resident masters students which resulted in a wide-ranging discussion of the residential masters program. We next discuss these two categories of masters programs.

4.1 Resident masters programs

The RC review of the resident masters programs led to a very positive evaluation. There are several distinct aspects of these educational programs that were considered including: the content of the programs, their relevance to the Navy, their distinction with respect to programs offered by civilian universities, the quality of the instruction, and the monitoring exercised by the department to ensure the continued quality of the programs.

The curricula of the resident masters programs have a number of important strengths. First, the actual program is 8 quarters in length (7 for USMC students). The material covers all four of the “pillars” of OR (statistics, stochastics, simulation, and optimization) and provides a number of courses with topics specifically designed for military officers. This is a technically demanding curriculum and the program is available to most students, some with limited technical backgrounds. This is made possible by the provision of a “refresher” quarter in which topics such as calculus and computer programming are provided to ensure that students are prepared to enter the actual program.

In addition to the military-specific courses in the curricula, the program provides the possibility of an “experience tour” in which students can apply their classroom work to actual Navy or DoD problems. Moreover the curricula include a masters thesis in which students address Navy and DoD relevant problems. The thesis topics can be generated either by the students based on their military experience who then find an appropriate faculty advisor or from faculty research problems. It is important to note that some of the thesis work made use of the special research facilities in the OR Department (for example the SEED Center). These three features (military-specific courses, experience tour and thesis requirement) in addition to the presence of some military faculty strongly differentiate the OR masters degree programs from those offered by civilian universities. In summary, the NPS OR Department offers highly unique educational programs of great relevance to the Navy.

A second aspect of investigation was discussions with students about their experience in the OR program. The group of 10 students we interacted with were outstanding representatives of the OR Department and NPS itself. They were articulate spokespersons for the quality of the program and their experiences. In particular, they commented on the excellent integration across courses that they experienced. One student remarked that it was not uncommon for them to learn material in one class and soon thereafter to apply that material in another. This tight integration
across courses can strongly reinforce student learning. The students strongly praised the teaching and each of the students were very happy with their choice of OR and saw great value to them and to the military in their studies. The students did raise some small issues and the students argued among themselves about the way certain courses were taught (for example, some students believed that fewer languages should be used in simulation so they became more proficient in one or at most two languages, while other students believed that it was better to be broadly exposed to different languages). Nevertheless, they did feel that the department was very responsive to their concerns. Overall, the RC was very impressed by the students themselves and are pleased to report a high degree of satisfaction with their educational experience within this group of students.

The RC considered the question of departmental monitoring of the educational programs. Every two years the program sponsor provides an evaluation of the curriculum of the program, and the RC was provided with copies of some of those evaluations. These were all strongly positive and made only minor suggestions for any change. These external evaluations coupled with the student evaluations of each course provide excellent feedback, and the department appears to pay strong attention to it. The RC has only one suggestion: as a part of its future strategic planning exercise, the department should take a close look at its curriculum in each of the four pillar areas as well as the additional course work and ensure that it is teaching the most modern ideas in each of these fields. There have been important developments in several of these areas (e.g. the revolution in data science), and it is important that the department curriculum stay reasonably current with them.

Finally we report some information that the RC heard but did not have time to investigate in depth or to document. We were told that fewer Navy officers were enrolled in some OR resident programs than could have been accommodated, and that in at least some cases officers from other services were enrolling instead. It was suggested to us that a reason for this stemmed from the currently low probability that Navy line officers would be selected for promotion. According to this account, NPS education for line officers is not valued by promotion boards as much as is service in regular line assignments: e.g., at sea, and therefore many capable line officers are going to line assignments rather than to NPS.

We think that if this information is correct then the current situation may put NPS at a disadvantage, not now but in the future. In the past, Navy line officers graduating from NPS have frequently been promoted to high rank in their subsequent careers, and some of these have been assigned to positions in Washington in which they could provide valuable support to NPS. If the flow of Navy line officers through NPS were to decrease, then in the future so would the number of these high-ranking officers. Although, as stated, we were not able to look further into this reported situation, we report it in case NPS may wish to do so.
4.2 Distance learning (DL) masters programs

4.2.1 Background

The three DL programs currently led by the OR Department are: the Master of System Analysis Program (MSA), the Master in Human System Integration Program (HSI), and the Master of Cost Estimating and Analysis Program (MCEA). While these three DL programs were created and continue to be led and offered by the OR Department, today there are numerous additional DL programs offered in other NPS Departments in concentration topic areas such as cyber defense and system engineering.

The growth of the DL programs in the NPS OR Department over the past ten years has been quite impressive. Today, approximately 50% of the students in the OR Department are currently registered in the DL programs—programs that were nonexistent or nascent just a decade ago. Also, the composition of a student cohort in the DL programs is fundamentally different from the cohort in the resident programs, with government civilians accounting for nearly half of the registered students in the DL programs in the OR Department.

There are many similarities between the three DL programs offered in the OR Department. All three programs are DL graduate degree programs involving two courses per quarter for eight quarters, or two years. A typical program quarter involves one course taught asynchronously to provide flexibility to the student, and one course delivered synchronously via a 3-hour session during working hours. Also, each DL program director indicated that an optimum cohort size is approximately 25-30 students. The RC observes that each of the DL programs has generally been successful at achieving this cohort size during the last five years.

There are also significant differences among the DL programs in the OR Department. While the MSA and the MCEA programs enjoy strong resource sponsorship in N81 and NAVSEA 05C, respectively, the HSI program does not enjoy the benefits of a single resource sponsor in the Navy. This makes the process of gaining firm resource commitments more challenging for the HSI program. Also, the lack of Department resources available to the DL programs—particularly in administrative and technical support areas—was noted in several of the DL program presentations. For example, DL program directors are responsible for the recruitment, applicant interaction and review; program funding, budgeting and contracting; and program quality including program content, faculty assignment and curriculum reviews. Many of these burdens are not shared by the corresponding faculty in the resident programs.

4.2.2 RC findings on distance learning

The OR faculty expressed concern to the RC over the growth of DL programs. These concerns appear to be based on three issues: 1) the DL programs do not have a thesis associated with them, 2) the OR faculty has suffered a significant drop in their faculty size and is hard pressed to
take on the extra burdens of distance programs, and 3) the distance programs place a very significant administrative burden on the program directors and the department is unable to supply any additional administrative support to them. Given the strong success of the distance programs, the department fears further growth is inevitable, growth that they are not properly resourced to handle.

The RC finds that the tension between the Resident and DL programs in the Department is not constructive, and likely results from key problems discussed earlier in the report: (1) over-regulation of resources and personnel; and (2) the lack of a strategic plan at both the level of the OR Department and NPS. These problems lead to an internal view within the OR Department that is completely resource-constrained, and zero-sum in nature. Under these conditions it is not surprising that some OR Department personnel indicate the need and desire to “constrain” growth in DL programs.

4.2.3 Importance of DL programs

The Department of Defense is today, and is likely to remain, one of the largest organizations in the world operating on a 24/7 basis, globally, with a total force of nearly three million military and civilian personnel. From a larger DoD perspective, the DL programs have risen and grown from the need to educate DoD personnel who are unable to attend graduate education programs on a full-time basis. This situation occurs quite frequently in DoD for a variety of reasons. Therefore, it is possible that future growth in DL programs may be entirely appropriate to best meet the needs of the Navy, the DoD, and the US Government (USG), and this presents a very important opportunity for the OR Department (and NPS more generally).

The case in support of the DL programs—for both the economics of education and the potential for outreach and impact upon the larger institutions—is very compelling. Also, the NPS DL programs offer a unique opportunity to improve the education of the DoD civilian workforce. These personnel work side-by-side with the military personnel in the Department to achieve favorable outcomes. Educating this workforce is entirely consistent with the goals established by the Secretary of Defense in 2017 creating cross-functional teams for improved mission effectiveness. Finally, the RC observes that the OR Department and the larger NPS have developed valuable competencies and skills in administering and executing DL programs for DoD. For example, NPS has already developed the necessary infrastructure and skills to deliver highly classified DL courses to DoD military and civilian personnel deployed and working in various global locations on topics such as cyber security. The ability of NPS to deliver this level of tailored DL course is enormously valuable to the Department of Defense, and directly supports the achievement of positive outcomes for the range of complex, difficult missions undertaken on daily basis throughout the world.
4.2.4 Opportunities for NPS in DL programs

The OR Department and NPS DL programs today compare favorably with peer organizations in DoD and also with private/public sector institutions of higher learning. However, many of these institutions, such as the Air Force Institute of Technology (AFIT) and Defense Acquisition University (DAU), have initiated efforts to improve and expand their DL programs. Also, highly ranked OR programs in public institutions such as Georgia Tech, a peer competitor to the NPS OR Department, are proving to be quite agile and are beginning to offer DL programs leading to degrees that are identical to those offered by their in-residence programs. Nevertheless, more DL educational opportunities in OR are becoming available, and both the OR faculty and NPS administration should recognize the ability of the NPS OR Department to offer a “military-specific” OR education, something that civilian universities are not capable of offering. Thus there would appear to be an excellent educational opportunity for the NPS OR Department that would benefit the DoD. Still, the OR Department at this time cannot consider any expansion of its offerings whatsoever until its faculty size is restored and any expanded programs are properly resourced. The NPS academic administration may want to take a close look at DL opportunities across the school in its strategic planning process.

The OR Department faculty associated with DL programs demonstrates considerable ingenuity and resourcefulness in securing funding and resources for the students enrolled in the programs. For example, the MCEA DL program faculty point out that this program relies heavily on Defense Acquisition Workforce Development Funds (DAWDF, or ‘Section 852 Funds’), a new appropriation created by Congress in 2009. Today this source of funds is used to support both military and civilian personnel enrolled in the MCEA DL program. Recently, the House Armed Services Committee (HASC) made note of the use of DAWDF funds for innovative education programs throughout DoD, and is considering expanding the availability of these funds to educate the DoD workforce beyond those directly involved in acquisition, to include those employees indirectly involved in support of acquisition. This change could significantly expand the pool of DoD employees interested in being students in DL programs, and provide this broader population with ready access to DAWDF resources to fund their participation as students in these programs.

4.3 New Developments in Education

We briefly mention that there have been many recent innovations in education including, of course, DL. Specifically, there has been a major increase in the understanding of how students learn as well as the creation of technology to support that learning. For example, there is much research to show that “active learning” and “flipping the classroom” can provide much better student learning outcomes than the traditional lecture method. For distance learning, it is thought that rather than providing one long period for lecture, that period should be broken up into smaller modules with exercises or activities inserted between modules to anchor the concepts that were just covered.
The RC did not hear about or investigate any of these educational developments as they pertain to the OR Department educational mission. Generally, an individual department does not have the expertise in the area of innovation in educational technology or pedagogy to be able to effectively evolve on its own. This is especially true for the OR Department, whose faculty is undersized to meet all its current obligations let alone to take on new ones. Rather, any evolution in educational technology and pedagogy is best undertaken at the NPS level. For example, the NPS organization PETAL (Promoting Excellence in Teaching to Advance Learning) would seem to be a natural organization to provide the expertise and training for faculty wishing to learn about and perhaps incorporate these innovations into their own teaching. Ultimately, the new research in improving student learning, the advances in educational technology, and the rise of distance learning program are topics that must be wrestled with by all educational institutions including NPS. The RC suggests that these topics be part of the overall NPS strategic planning process.

5 Summary of Conclusions/Recommendations

From Sections 2 and 3:

**Conclusion:** The NPS OR Department has been and is still the unquestioned leader in military OR. Furthermore, this department is widely known for its work in the broader category of applied OR. However, its ability to sustain that impact is very much in jeopardy: in effect, the department is nearing the edge of a cliff.

**Conclusion:** Unless immediate steps are taken to increase the size of the faculty, the NPS OR Department will not be able to sustain the remarkable impact it has had on the Navy and DoD or on the practice of OR more generally.

**Conclusion:** Faculty face severe and seemingly unwarranted regulations and long delays until issues are resolved. These faults are hindering recruiting as well as other departmental functions.

**Conclusion:** Current policies and practices of the NPS non-academic administration appear to be reducing the effectiveness of the OR Department in several ways. These constraints generally are of two types: (1) declining to allow the faculty to do things that in the view of the RC should be permitted, and (2) taking exorbitant amounts of time to process straightforward requests.

**Recommendation:** The academic and non-academic parts of the administration should work together to create an NPS environment that is less regulated but is still compliant with the rules and policies of the Navy and the DoD.

**Recommendation:** The OR Department should as soon as possible prepare a strategic plan containing, among other things, a description of the research directions that it will emphasize in the future. It should revise that plan as needed to keep pace with future developments in the relevant academic disciplines.
Recommendation: NPS should consider exploring the extent to which resident attendance by Navy line officers may have changed, and the possible causes and consequences of any such changes.

From Section 4:

Conclusion: The resident masters programs of the OR Department offer highly unique educational programs of great relevance to the Navy.

Conclusion: The resident students reported substantial satisfaction with their educational experience and the relevance of their programs to their future careers.

Conclusion: The OR Department is effectively monitoring the quality of the curriculum through course coordinators, student evaluations, and biennial sponsor evaluations.

Recommendation: As a part of its future maintenance of the strategic plan, the OR Department should review its curriculum in each of the four pillar areas as well as the additional course work, and ensure that it is teaching the most modern ideas in each of these fields.

Conclusion: The distance learning (DL) programs present a very important opportunity for the OR Department (and NPS more generally) to serve the needs of the Department of Navy, the Department of Defense, and the US Government.

Conclusion: The case in support of the DL programs—for both the economics of education and the potential for outreach and impact upon the larger institutions—is very compelling.

Conclusion: The OR Department and NPS DL programs today compare favorably with peer organizations in DoD and also with private/public sector institutions of higher learning.

Conclusion: There is tension in the OR Department between the Resident and DL programs. This tension, which is not constructive, likely results from deficiencies pointed out above: insufficient numbers of faculty, over-regulation, and the lack of strong strategic plans at both departmental and NPS levels.

Conclusion: Over-regulation has led to current under-resourcing of the DL programs. Despite this, the DL programs have been successful in the past decade.

Recommendation: It is essential that the future of DL programs be considered as part of the effort to create a sound strategic plan for the OR Department, as well as the whole of NPS;

Recommendation: For the OR Department and NPS to remain a DoD center of excellence in DL programs, the DL program path outlined in the strategic plan must be properly resourced. There are a variety of ways in which this can be accomplished.
Recommendation: In its strategic planning process, NPS as a whole should take into account new research in improving student learning, advances in educational technology, and the increasing demand for distance learning programs.