Report of the Ad Hoc Committee on the Military Presence at MIT

1) Introduction

In the spring of 1985, forty faculty members signed a letter to the Chairman of the Faculty questioning the impact on education at MIT due to the shift of government support for scientific research and education from the civilian to the military sector. The question was further discussed at the faculty meeting of March 20, 1985. In response to this discussion, the Chairman of the Faculty announced in May, 1985 the appointment of an ad hoc committee to "gather facts, organize them in a suitable fashion, and present them to the faculty for discussion." The Committee consisted of Professors Herman Feshbach (Physics), Allan Henry (Nuclear Engineering), Carl Kaysen, Chair (STS), James L. Kirtley, Jr. (Electrical Engineering), Vera Kistiakowsky (Physics), James R. Melcher (Electrical Engineering), and George W. Rathjens (Political Science); Ms. Louisa Koch (Graduate Student) and Mr. Daniel O'Day (Undergraduate Student).

The Committee has engaged in three formal data gathering efforts: a questionnaire addressed to the faculty, a questionnaire addressed to the students, and a re-tabulation of administrative data generated by the Office of Sponsored Research and the Controller's Office. In addition, we have drawn on alumni records, the records of the Placement Office, and information provided by the Associate Provost and Vice President for Research. We have also discussed the problems we are addressing informally with our colleagues and met with members of the faculty committees on the Lincoln and Draper Labs, the commanders of the ROTC units, and the Chairman of the Faculty Committee on ROTC. We wish to express our appreciation of the generous help we received from all our Institute colleagues.

The report is organized as follows. Section 2 discusses the responses to the faculty questionnaire; Section 3, responses to the student questionnaire; Section 4, changing importance of sources of research support, including a comparison of MIT with other universities and a comment on Lincoln and Draper Labs; Section 5, ROTC; Section 6, students' choice of careers; Section 7, SDI and MIT; Section 8, comments, observations, and issues for further faculty reflection and discussion.

2) Faculty Questionnaire

The Committee sent a questionnaire to every member of the faculty on 12 September, 1985 via Institute mail; 378 responses were received. On October 5, department heads were asked to remind their colleagues who had not yet responded to do so. This produced another 52 responses, for a total of 430, or 45% of the faculty. The distribution of responses among schools and departments, and the laboratory affiliations of those respondents indicating them are shown in Tables 1a and b of Appendix A.

Demographics

The sample of responses is large and well representative of the Institute in terms of departmental affiliations; no group was conspicuously unrepresented. Answers were analyzed by schools rather than departments - in part in the interests of confidentiality - in a three-fold classification: Engineering, Science, and Other (Architecture, Humanities and Social Science, Management, and Whitaker). Faculty of the School of Engineering, 39% of the Institute total, were somewhat overrepresented among respondents at 43%; the School of Science with 29% of the Institute's faculty provided 29% of the respondents; the three other schools and Whitaker 28% of the respondents as against 32% of the Faculty.

Not all respondents answered all questions. The factual questions -- numbers 1-19 -- typically showed about 30-40 missing responses, or about 10%. The exception was question 18, on consulting relationships, where missing responses ranged from 15 to 20%. The opinion questions on SDI, numbers 20, 21, and 22, also showed 15-20% missing answers. Highlights of the responses follow; the complete tabulation is shown in Appendix A.

In the broadest terms, the faculty welcomed the inquiry (81%, Q4); and a large minority, 39%, registered awareness of such effects of military funding as "restriction of publication, restriction of students' choice of major, and changes in the direction of research" (Q3).

Research support

Most faculty members showed diversity in their sources of research support (Q7). Ranked by the percent of respondents listing them as providing some support, funding sources were:

NSF, 39%; industry other than major defense contractors, 31%; DOD, 25%; MIT, 20%; DOE, 19%; private foundations, 19%; NIH, 14%; other Federal agencies, 14%, NASA, 12%; other than specified, 12%; and finally, listed major defense contractors, 5%. Very few faculty members relied entirely on one source for all funding: 5% on DOE; 4% on MIT; 3% on NSF; 2% on NASA; 2% on NIH. More frequently, a funder provided less than half of the support for any particular faculty member: for NSF, 22% of the 39% reporting NSF funding; for other industry, 20% of 31%; for DOD, 12% of 25%; for DOE, 10% of 19%. Not all respondents were clear on identifying their sources of support in terms of the classifications used. For example, one identified his source of support as "Other," and in the comment specified it as "ONR," not recognizing it as part of "DOD." We do not know how frequent such mistakes are.

Partitioning the support from each sponsor as paying for "basic science, more applied work with broad commercial and military applications, (or) work with specific military applications," very little showed up in the last: overall, 5% of work supported by major defense contractors, 3% of that supported by DOD, 2% of that supported by NASA, and also by other (unspecified) sources, and 1% of that supported by other Federal agencies and private foundations - the latter probably work in arms control. For NSF (83%), NIH (81%), private foundations (67%), DOE (65%), NASA (64%), MIT (61%), and other Federal agencies (60%), more than half the support was for basic research. For major defense industries (73%), DOD (64%), and other industry (56%), more than half was for more applied work of general application.

A little more than a quarter of the respondents reported substantial shifts in funding in the last 5 years, (Q9a). There seemed to be no clear pattern to the shifts (Q9b, Appendix A, Table 2a). A quarter of the respondents reported shifts in the direction of their research; three quarters, none (Q10a). Those responding to Q10b on the nature of the shift indicated some net shift away from basic science (44% less to 30% more and 26% the same) and some increase in specifically military research (75% or 18 out of the 24 reporting changes in this area with more, 3 each with less or the same). Research of broad general application showed almost no net shift, with 66% reporting the same level, 18% more and 16% less. Nearly 70% of those

explaining the change attributed it to a change in their research interests (Q10c) (Appendix A, Table 2B). Only 4% reported moving away from research areas because they became militarily sensitive or classified (Q11).

Restrictions on research and military funding

Only a minority of the faculty said that they would accept classification or other restrictions on research (Q12, 13a-b). Twenty-one percent would continue their research even if their area became militarily sensitive or classified; 47% would discontinue. Of the remaining 32% answering "other" (120 respondents), some (26 respondents) would "kick and scream," negotiate to declassify, try to find other funding, oppose classification; some (21) denied the premise of the question, several stating that classified work is not allowed on campus. On other restraints: 25% would accept a requirement for faculty security clearance; 14%, exclusion of non-US citizens; 12%, students security clearances; and 9% each, pre-publication review and later classification at the sponsor's request. (One faculty member commented that he/she now preferentially selects U.S. graduate students.) Between 20% and 30% were unsure of their response in each case; a majority (55% to 68%) would refuse the restriction. A majority of the faculty perceived an increase in the availability of military funding relative to the other sources in the past 5 years, (Q14): (53% yes, 17% no, 23% unsure); but did not expect an increase in the fraction of their own research support that would come from military sources, (Q15): (66% no; 13% yes; 21% unsure). Military examples were seen as playing a small role in teaching; research for specific military applications, a very small role in supporting student research at all levels (Q16, Q17).

Thirty percent of the respondents reported that their students' research was supported by DOD, but more for basic science than for applied research of general application, particularly for the graduate students (Q17).

Finally, 11% of the respondents are now consultants on DOE sponsored weapons programs or DOD sponsored programs; 16% have been at some time (Q18).

Differences among schools

On the whole, responding faculty members in the School of Engineering are more involved with military support for research

than others; and they express less concern about its possible negative consequences. The small share of respondents who found the questionnaire inappropriate were disproportionately in the School of Engineering: 10% of that group, versus 3% of the others. Proportionately more Engineering School faculty reported reliance on support from DOD and major defense contractors than others, and for DOD, Engineering had a disproportionate share of those with 50% or more support, and of the few with 100% support. Among those reporting a shift in the area of their research, Engineering School respondents reported a relative shift away from basic science in comparison with those from the School of Science who reported a shift towards it. Proportionately more respondents in Engineering attributed their shift to a change in funding, 31% versus 17% in Science and Other. A higher share of Engineering School respondents expected to receive more of their support from military sources - 18% versus 9% in Science and 8% in Other. As might be expected, a disproportionate share of the students working with DOD support were reported by faculty in the Engineering School - 45% versus 22%. The few students at all levels working on specific military applications - 2 UROPS, 1 bachelor's thesis, and 6 graduate theses - were all reported from the Engineering School.

The answers to Q13 also show some differences in attitude between respondents in the School of Engineering and other schools, though not large ones. A somewhat higher proportion (16% versus 12% in Science and 11% in Other) would accept the exclusion of non-U.S. nationals and prepublication review by sponsors (9.5%, 7.7%, 8.2%). A smaller proportion (58%, 67%, 67%) would refuse to accept the sponsor's right to post-facto classification, and a higher proportion are unsure of their response (33%, 24%, 27%). A substantially higher proportion would accept a requirement of security clearances for faculty (31%, 25%, 20%), but not for students, where the proportions accepting are about the same (12%, 11%, 13%).

Answers to Q19 through Q22 -- on SDI -- are discussed in Section 7, along with student responses to similar questions and other materials bearing on SDI.

3) Student Questionnaire

Introduction

A questionnaire directed at all students, undergraduate and graduate, was initially distributed in Dupont Gymnasium on February 4, 1985, Registration Day for the Spring semester. Copies were also available to students for the next two weeks in some of the living groups and the Undergraduate Association Office. The survey's purpose was to gather student views on the impact of the military presence on MIT's educational environment.

The response rate to the survey was reasonable. Excluding special students, the Registrar reported that there were 4385 undergraduate and 4495 graduate students at the start of the Spring semester, for a total of 9380 possible respondents. The committee collected at Dupont and received through MIT mail 1751 completed surveys, a response rate of 19% overall, 20% for undergraduates and 17% for graduate students, a respectable return for a long questionnaire, especially in the situation in which most students filled it out. The non-response rate was possibly higher among students without interest or strong opinions on the subject of military influence at MIT, and the survey results may possibly be biased toward the extremes.

The survey questions can be divided into several blocks by topic. Eight preliminary questions provided demographic information: Q1-5 about the student's level of interest and some general opinions; Q6-10 were about Co-Op's; ROTC was the subject of Q11-15 and Q32, Q33, and this information is discussed in Section 4 on ROTC. Questions 16-21 dealt with research issues and Q22-24 foreign students. The degree of militarization in career fields was addressed in Q25-31, while Q34-39 examined the military's influence at MIT. Finally, students were polled for opinions on the Strategic Defense Initiative in Q40-42; their views are discussed in Section 7 below.

The aggregate responses in percentage terms are shown in Appendix B.

Demographics

Approximately half of the respondents were between the ages of 20 and 24, and a third were 25 or older. Of the valid responses, 76.5% were from men and 23.5% were from women (2.3% of the surveys received did not have an answer). The MIT population is 77.2 % men and 22.8 % women. The responses were divided almost exactly evenly between graduate and undergraduate students, roughly in line with the total division of enrollment at MIT, 47% undergraduate and 53% graduate. Among undergraduates, the division between classes was approximately uniform, although seniors had a slightly higher response rate. The vast majority (86.7%) were U.S. citizens, 3.7% were resident aliens, and 9.7% were non-resident aliens. This is significantly lower than the 23.8 % non-U.S. students reported at MIT by the Registrar. Nearly half of the respondents indicated that a Ph.D. was their ultimate degree objective, while only 16.2% indicated that they would stop with a B.S.. Breakdowns by department and humanities concentration are included in Appendix B, Table 1.

Level of interest/general opinion

There is considerable interest among students about the level of military influence at MIT. Over two-thirds of the respondents welcomed the committee's inquiry, with a warmer reception given by graduate students and those not in the School of Engineering. Interest in the subject seemed to increase with class year (the percentage of graduate students indicating great interest was nearly twice that of freshmen), while it was relatively constant (differing by less than 5%) across gender, citizenship and school.

Given the level of interest indicated, the responses to Q3 and Q5 seem a bit odd. Only a quarter of all students consider themselves to be relatively well-informed on the issue of military influence at MIT. Again, upperclass and graduate students think themselves better informed, but a significant difference also exists between men and women and between resident and non-resident aliens. Thirty percent of the men and 27% of residents consider themselves to be well-informed compared to only 12% of women and 17% of non-residents.

Discussion of the issue of MIT's military involvement among students is frequent: over 80% have addressed the issue with other students at least occasionally and 60% more than occasionally; and these numbers are relatively uniform for all

classes and schools. On the other hand, 75% have never or rarely talked about it with advisors, professors and TA's, a striking difference, especially in the light of the desire for information shown on answers to a later question (Q31).

Co-Operative programs

Fewer than one MIT student in six has participated in a Co-Op program. Predictably, the majority of these people are in the School of Engineering and a high percentage are U.S. citizens (93%). A considerable number (40%) said that they worked for defense contractors and slightly over a quarter thought that the projects they worked on were defense-related. Invited to guess what percentage of internships overall were defense-related, only 4% said less then 20%, and 17% said more than 60%.

Research

These questions were answered by students doing research, 70% of the respondents. Nearly half were doing research for a thesis, a small number were working outside MIT, and the rest were about evenly divided between R.A.'s and UROP's. Nearly everyone knew the source of his funding. Two and one-half percent (30) were doing work with a specific military application, and 11% (131) had a security clearance. Thirty-eight students had submitted to a pre-publication review: 16 by DOD, 4 by NASA, 2 by CIA, and the balance by various others. Thirty-one of these were graduate students. Five percent (81) indicated that they worked for Draper or Lincoln.

Questions asked of non-U.S. citizens

These questions dealt with the participation of foreign students in research. Of those who felt they had been excluded from an on-campus research opportunity (66 cases) or work at Draper or Lincoln (74 cases with some overlap probable), the majority cited U.S. national security as the reason they couldn't participate. Nine of these people were extremely disappointed and had to alter their educational plans. Thirty-one others found that the restrictions were a problem, though not a serious one. Seventy percent of the serious

difficulties were encountered by graduate students, and two-thirds of all the responses were by graduate students.

Influence of military on choice of field of study

Students indicated that the degree of military orientation of a field of study has been a factor in their selection of a career field. Two-thirds said they have an aversion to working for the military, 29% "strong," 38% "mild." Most people attributed this aversion to worries about the arms race, opposition to U.S. foreign and military policy, and the desire to do economically productive work. Job security was clearly not a factor.

The majority of students in the School of Science and other schools believed that less than 20% of the jobs in their field were military-related. However, the bulk of engineering students felt that the number was between 20% and 60% for their fields. The percentage of engineering students with a strong aversion to military work is half that of students in the other schools. There were also considerable differences in the reasons given by the two groups for disliking military work.

Approximately one student in ten has altered his or her career plans because of the degree of military orientation of their original fields. Another 10% is considering a career change. However, 45% said that the degree of military orientation was not an issue for them, while 27% said it might be if they had more information on the military orientation of their specific fields.

There is a clear call for more information on the military dimensions of various career fields. Fully 75% said this would be a good and helpful idea. The demand for this type of information was particularly great among upperclassmen and those in the School of Science.

MIT's involvement with the military

Two-thirds of the respondents believe that MIT has a close association with the military. There is, however, considerable uncertainty about what the results of this association have been.

More than half of the students believe that MIT has a much larger portion of its research funded by the military or military contractors than most schools. About half also think that this amount has been increasing over the past few years. However, the students as a group seem undecided about the degree to which this involvement has influenced the educational environment here. Few individuals chose either extreme of no influence or great influence, and a relatively high percentage indicated that they didn't know. Similarly, when asked what the general effect of this funding has been on MIT, equal numbers answered positive and negative, and the great majority answered either neutral or unsure.

The survey asked students to evaluate the mechanisms by which any military influence is exerted. Many identified military research funding, the number of military-related companies which recruit students on campus, and MIT's association with Lincoln and Draper Labs as the primary sources of military influence. Ties between MIT community members and outside contractors was seen as somewhat less important, while the majority did not feel that the ROTC presence, or class and problem set examples were significant factors. These results indicate that students see the greatest military influence being exerted via economic mechanisms.

Cross-tabulation shows that foreign students were somewhat more unsure of the effects of military funding on MIT than U.S. citizens. Graduate students and upperclassmen saw the effects more clearly than freshmen. Responses from men and women were quite similar except in a few places. Fewer women indicated that MIT conducts more military research than other schools, they don't see it growing as quickly, and only half as many thought it has a positive impact on MIT. Finally, students in the School of Engineering have noticed a military influence at MIT far less than their counterparts in the other schools. This is significant since most military-related careers and research is associated with the engineering disciplines.

4) Changes in Sources of Research Support

The Institute as a whole

Over the ten year period 1977-86 total on-campus research in current dollars grew at an average rate of about 12% per year; in constant dollars, the average growth rate was more like 5%, somewhat higher in the first half of the period, and lower in the second. The 1985 total figure was $240 million; the 1975 in 1985 dollars, $143 million; the 1986 total is forecast at $262 million.

Figure 1 (Appendix C) shows the movement of the relative shares of the major classes of sponsors over the decade. In order of their importance in 1985 they were: Department of Energy (DOE), 23.3%; Department of Health and Human Services (HHS), 16.7%; Department of Defense (DOD), 16.0%; National Science Foundation (NSF), 13.9%; Industry, 13.8%; Foundations and Other Non-Profits, 6.3%; National Aeronautics and Space Administration (NASA), 5.1%; Other Federal Agencies, 5.8%; MIT, Lincoln and Draper, 1.1%; State, Local and Foreign Governments, 0.2%. The forecast for the current fiscal year shows the same first three sponsors in order, with a small decline in the DOE share, to 22.5%, and increases in HHS and DOD to 17.1% and 16.8%, respectively. Industry at 14.7% is expected to exchange places with NSF at 13.9%, followed again by Foundations and Other Non-Profits, 6.3%, NASA, 4.8%, Other Federal, 3.1%, MIT, Lincoln and Draper, 0.8%, and State, Local, and Foreign Governments, 0.1%.

DOE has been the largest funder since '78; moving up from third place in '76 to second in '77. HHS has been in second or third place every year except one. DOD has risen from fourth place to second or third; NSF has fallen steadily from first place with a 20% share to fourth with 14%. The dollar figures and percentage shares are shown for all seven source groups in Table 1 (Appendix C).

Figures 2 and 3 (Appendix C) show DOD-sponsored research on campus for 1976-86 and three earlier years 1967, '68, '72; Figure 2 the research volume in constant 1985 dollars; Figure 3 the fraction of all sponsored research. Both the absolute level and the share were higher in the late 60's—the share far higher than it is today. The volume of DOD-sponsored

research fell by more than 50% between '67 and '77; in the last decade it has risen steadily. The share declined more sharply in the first decade; then has grown each year in the '80's with one exception; the defense share is now nearly 1.5 times what it was in 1980.

The prospects are strong for a continued increase in the relative importance of DOD funding in the near future. The most recent AAAS annual report* on the Federal R&D budget forecast defense R&D increasing 25.5% in terms of budget authority measured in constant dollars in the two-year period FY '85-87; while the corresponding non-defense figure is a decrease of 6.0%. Looking in more detail at major Federal sponsors of MIT research, the forecast changes FY '87 over FY '85 in constant dollars are DOE, -19%; HHS, -3.6%; DOD, +20.1%; NSF, +9.2%; and NASA, +21.5%.

DOD is not the only research sponsor with military goals. Some activities of both DOE and NASA are militarily related. Figures 4 and 5 (Appendix C) show the absolute volume of research in 1985 dollars sponsored by DOD, DOE, and NASA, and its relative share of all on-campus sponsored research. The totals in '67-68, '80-81, and '84-85 are similar, the levels of '80 and '85 are each slightly higher than that of '68. The relative share of the three sources declines sharply between '67 and '76 and then rises unevenly, remaining well below the earlier level.

In interpreting these data, it is helpful to remember the faculty's answers to the question (Q8) asking for the division of research supported by each sponsor between "basic," "applied general," and "more specifically military application." For DOD, the average value for the three categories was 33%, 64%, 3%; for DOE and NASA they were 65%, 35%, 0, and 64%, 31%, 2%, respectively. In recent years, the largest recipients of DOE support at MIT have been the Laboratory for Nuclear Science, the Plasma Fusion Center, and the National Magnet Laboratory.

In sum, the Department of Defense is not the most important source of support for research at MIT. Indeed, in terms of both constant (1985) dollar volume and share of the total, support from DOD is less now than it was in the late '60's. Over the last decade,

*American Association for the Advancement of Science, AAAS Report XI: Research and Development, FY '87.

research support from Industry has been growing more rapidly than that from any other source. However, the projected growth in DOD support for the current (1986) year (14.0%) is somewhat larger than that for the growth in support from Industry (13.4%). While the broad grouping of DOD, DOE, and NASA fund nearly half of MIT's research, it is inappropriate to view them as all of a piece, and this is a smaller share than it has been in the past.

Selected departments and laboratories

So much for the picture of research support in the Institute as a whole. Schools, departments, and laboratories vary greatly in the degree to which they draw on the different classes of sponsors.

Table 2 (Appendix C*) shows what laboratories and departments have displayed substantial dependence (≥ 25%) on support from DOD, DOE, or NASA for selected years in the period 1967-84. Only units with research volumes of ≥ $500K before 1980, and ≥ $1M thereafter are included.

Table 2 portrays a general picture of change and fluctuation. Table A on the following page singles out those units with high support (≥ 50%) from a single funding agency for several periods.

MIT in relation to other universities

In 1985, MIT, exluding Lincoln, was the largest on-campus university contractor. MIT has held first place in this list for five of the nine years, falling to second for three and third for one (see Appendix C, Table 3).**

These facts can be seen in another perspective by comparing MIT's share of Defense Department funding with the share for universities as a whole. In 1983, the last year for which data are available, DOD was the source of 18.1% of the Federal support for R&D at the 100 largest academic recipients of Federal funds, or about 11.6% of total research support. The

*Specifications for the tables are contained in the Appendix.

**Appendix C, Table 4 and footnote bear on the problems of getting comparable figures that include Lincoln with MIT and similar labs with other universities.

Table A

Departments and Laboratories

Average Share of Support by Selected Funding Sources

Selected Years 1967-84

Funding Source and Unit	Period 1 1966-7	Period 2 1971-3	Period 3 1977-9	Period 4 1981-3	Period 5 1984
DOD					
Lab for Computer Science	-	-	51%	74%	71%
AI Lab	-	89%	55%	86%	62%
Electrical Engineering (ex separate labs)	56%	62%	28%	50%	50%
RLE* (2 periods only)	39%	27%	21%	43%	40%
Project MAC	100%	95%	-	-	-
Department of Architecture	-	-	56%	85%	-
Lab for Information and Decision Systems	-	-	-	57%	55%
DOE					
Lab for Nuclear Science	87%	100%	64%	99%	99%
Plasma Fusion Center	-	-	-	95%	96%
RLE*	9%	11%	21%	2%	1%
NASA					
Center for Space Research	83%	91%	83%	79%	68%
RLE*	16%	16%	4%	2%	3%

The ten different units appearing in this table compare with the thirty that appear in the Appendix Tables.

*RLE has been included, although it does not quite meet the criteria. The total of DOD, DOE, and NASA support is greater than or almost 50% in three periods and it is a large lab, with average real volume (1985$) of more than $10 million in every period.

corresponding figures for MIT in 1983 were 19.6% and 16.0%, respectively.

Another way of looking at the defense-intensity of MIT research support in relative terms is to look at the DOD research volume and obligations to MIT in relation to total DOD research volume and obligations to all universities. These are shown in Figure 6 (Appendix C); MIT's relative importance to the Defense Department as a supplier of research fell sharply from 1976 to 1979, then rose irregularly until '85. Figure 7 shows similar information for DOE; MIT's relative importance to DOE is on the order of twice that to DOD; it has fluctuated but not changed much in level for most of the period.

Lincoln and Draper Laboratories

Lincoln

The interim report of the Lincoln Laboratory Review Committee to the faculty on April 16, 1986 makes it clear that research opportunities at Lincoln are and will most likely remain oriented toward military applications. In response to a 1969 statement by the MIT Corporation's Executive Committee, there was a trend in the mid-1970's to include some non-military research. However, since about 1980 this trend has been reversed so that current opportunities for research overwhelmingly have military applications as an end-goal.

In 1985, there were 26 students doing thesis research at Lincoln, most of them supported by research assistantships. The laboratory is a strong contributor to the VI-A cooperative program with about 12 students participating this past year. About 23 MIT faculty act as consultants to Lincoln, 20 with stipend (further details are given in Table 5, Appendix C).

Draper

Even though it was written at a time when MIT was divesting the laboratories, the 1972 Articles of Organization for Draper Laboratory make it clear that an attempt would be made to continue its educational tradition. Currently introducing a section on educational programs in the Draper Laboratory

manual is the quote from those Articles that it is the objective of the laboratory ..."To perform and contribute to the support and advancement of scientific research, technology, and development and to initiate, maintain, and engage in educational activities in the sciences and allied subjects." Our interview with a representative of of Draper Laboratory emphasized this commitment to education and to continued ties to MIT. In that same manual, the statement is made that "The combination of coursework at the university with research conducted in the working laboratory continues a most effective educational experience."

Probably because of its proximity to the campus, MIT student interactions with Draper are, at least in terms of numbers, greater than Lincoln. In 1985, there were 54 Draper Fellows, on the increase from 37 in 1983. The number of students on the VI-A cooperative program was 8, with a decline in numbers from 13 in 1982, probably due to some concern on the part of the Institute with the educational experience provided. In addition, there were 9 students on the Engineering Internship Program. Draper's instinct for educational involvement, which can be traced to its origins at MIT, is evident in the trend toward involving more cooperative students from other educational institutions. There were 96 "coop" students at Draper from Northeastern in 1985 as compared to 46 in 1982. (Further detail is provided in Table 6, Appendix C.)

The Draper manual states that "The productive educational process in the Lab is not only a mark of student competence and interest, but, even more, of the care and dedication of the Lab supervisor leading the student. Draper's continuing relations with MIT are enhanced by those holding appointments (13) in the School of Engineering."

It seems clear that, even though the administrative relationship between MIT and Draper was severed in 1972, its campus influence remains essentially the same. Whether measured at the faculty-staff level or in terms of opportunities for student research support, Draper continues to have a greater influence on the MIT student environment than does Lincoln.

Comment

Both Lincoln and Draper staff take pride in their contributions to "real engineering objectives." At Lincoln, these objectives are clearly military. Especially at a time when the civilian missions of NASA are being supplanted by military ones, they are military at Draper as well.

5) ROTC

The ROTC program at MIT began in 1920 when an Army unit was established. In 1949 the Air Force program was started and in 1955, the Navy program. The actual programs have evolved over the years, particularly in 1969 when the anti-Vietnam war protests resulted in a consideration of the appropriateness of ROTC to MIT. The decision was to retain ROTC but to make some major revisions in the programs. ROTC was reclassified as an extra-curricular activity and no academic credit would be given for ROTC courses unless they were taught with an MIT academic department. ROTC instructors no longer would be given faculty positions and would instead have the title "visiting professor."

Several institutions in the Boston area did terminate their ROTC programs and in the early 1970's students from these institutions began to petition the Institute to allow them to cross-enroll into the MIT program. After several years of debate, MIT approved the cross-enrollment of Wellesley students in 1974, Tufts and Northeastern students in 1975 and Harvard students in 1976. Northeastern terminated its agreement with MIT in 1981 and its ROTC cadets now go to Boston University which also had two brief cross-enrollment agreements with MIT.

In 1983 the Planning Office prepared a report* on the the cost to MIT of the participation of Harvard, Tufts and Wellesley students in ROTC at MIT, and as a consequence these institutions now contribute financially to the support of the program. Appendix D, Figure 1 shows the enrollment figures for 1984 and 1985, and Appendix D, Figure 2 shows the Fair Share Expenses contributed.** The percentages are not the same in the comparable pie charts because the cost per cadet varies for the different ROTC units.

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* "MIT ROTC Cross-Registration," MIT Planning Office, December 1983.

** "MIT ROTC Cross-Registration," MIT Planning Office, November 1984.

Recent trends in participation

Appendix D, Figure 3, shows the number of students enrolled in ROTC for the year 1976 through 1985. There was an increase between 1976 and 1979, but since then the number has been approximately constant. Appendix D, Table 1, shows how this has been divided between the three programs, and it is seen that enrollment in the Army unit dropped and that in the Navy unit increased. Appendix D, Table 2, shows the number of scholarships involved; there was a 23% increase between 1980 and 1984 (the number for lags are projected figures).

The number of instructors involved in the three programs has increased somewhat since 1975. The Army program has had four or five officers and four non-commissioned officers. The Air Force program went from four officers and three non-commissioned officers in 1975 to six officers and four non-commissioned officers in the early 1980's and has remained at that level. The Navy program remained constant at the level of five officers and four non-commissioned officers until 1984 when a sixth officer joined that program.

Requirements of the ROTC program

Admission to the programs is restricted to U.S. citizens between 17 and 27-1/2 years of age who will be admitted to one of the colleges or universities in the program. In addition, the candidate must satisfy the physical requirements of the service (Appendix D, page 6, gives those for the NROTC) and have no moral obligations or personal convictions that would interfere with discharging the duties of the service.

At the end of the freshman year, a cadet wishing to continue in the program signs a contract to serve at least three years as a commissioned officer after completing the baccalaureate degree (four years in the case of students with ROTC scholarships). If the cadet leaves the program before graduation, there is an obligation to serve two years as an enlisted person, possibly immediately on leaving ROTC, possibly upon leaving MIT. Exceptions are made in the case of severe medical problems, but the obligation would exist if the student were discharged for disciplinary reasons.

At the beginning of the freshman year the student in the AFROTC is asked to submit an eight semester program of courses leading to graduation which is, however, non-binding. Appendix D, pages 7 and 8 describe the majors recommended and allowed for AFROTC and NROTC. A cadet may request a change of major after the initial choice, but this could be denied, especially if it were to a non-technical field. AFROTC encourages majors in engineering, physical science and business, and does not accept pre-law, pre-medical or music.

In addition to the standard academic program, military science courses and leadership training are required by all three ROTC units. AFROTC requires one hour of class and one and a half hours of training per week, and one weekend per semester at Fort Devens of freshmen. Upperclassmen have an additional hour of class per week and must spend six weeks in summer camp between their junior and senior years. These requirements have been the same since 1981. AFROTC requires one hour of class and one hour of leadership lab per week during the freshman and sophomore years, three hours of class and one hour of leadership lab during the junior and senior years. NROTC requires one to one and a half hours of class and one to one and one quarter hours of training per week. For scholarship students there are also three summer training periods of four to six weeks duration including two involving at-sea training. The non-scholarship students attend only one summer training period, between their junior and senior years. These requirements have been in effect since 1983. The full descriptions of the three programs in the current MIT catalogue are shown in Appendix D, pages 9 to 11.

It is not possible to transfer between programs. The student must drop one program before signing a contract to try another.

All three programs encourage applications to graduate schools in desirable fields and consider requests for delays in discharging the service obligations in order to first attend graduate school.

Freedom of speech and political activity

All three commanding officers (executive officer in the case of NROTC) who spoke to the Committee were asked to comment

on possible restrictions of freedom of speech of and political activity by the cadets. At our request, they furnished the Committee with written formulations of these constraints; these are shown in Appendix D, page 12. In every case, these are service policies. Each unit commander reported that no situations involving the appropriateness of students' conduct under these policies have arisen in recent years, i.e. within the period of their service.

The cadets are not subject to the Uniform Code of Justice. Legally they are civilians until they are commissioned. However, the consensus seemed to be that they are in the programs voluntarily and should not sign the contract if they have goals which are at variance with those of the service. If they have had a scholarship, they may request to be relieved of their obligation by paying back the amount which they received. However, the several services decide whether this will be permitted on a case by case basis.

If the cadet does not fit into the program because of grades or attitude, that person may be placed on conditional status. If on scholarship, this results in suspension of the scholarship payments. If the behavior of the cadet is not that of a future officer, that person's participation in the program would be terminated, in which case there would be a liability for the two years of service. If at the end of the four years the cadet was not recommended for a commission, the same liability would apply. However, the national office of each service's ROTC program could decide in both cases to waive that obligation.

Opinions on ROTC

Opinion on ROTC was not solicited in the faculty questionnaire, although several respondents volunteered comments, expressions of concern ranging from restrictions on choice of major to loss of freedom of speech. The student questionnaire had two sets of questions, one asking the views of all respondents and the other addressed to ROTC members.

The latter, Q11 to Q15, had only 83 respondents, 5% of the total sample, but 25% of enrollments in ROTC. Even this small sample showed certain broad features of the group. Factors that influenced students to join ROTC were, from most significant to least important, financial need, the desire to

serve their country, the professional benefits of a military career, and family military tradition. The group was evenly split about whether being in ROTC put constraints on their choice of field of study, but 95% indicated that they personally were unaffected by constraints. Finally, only 13% said that they were dissatisfied or very dissatisfied with ROTC. About half the forms had written comments added for Q15.

The second set of questions, 32 and 33, dealt with the student community views on ROTC. The largest group of students felt that ROTC was appropriate on campus (43%), nearly 6% thought it an excellent program that should be expanded, a significant number (19%) said they were indifferent, and about a fifth indicated that they were uneasy about it, but weren't sure what should be done. Most students do not approve of ROTC's policies toward homosexuals, but a sizable group (19%) strongly supports them. Slightly under half of the respondents do not think that ROTC has a positive influence on the educational environment, while 21% felt that it does. Opinions were split about whether MIT is a good place to conduct ROTC training and whether it contributes positively to U.S. national security interests. Thirty-one percent were neutral on the first of these questions and 30% on the second. More disagreed (39%) than agreed (29%) on the first issue; more agreed (40%) than disagreed (30%) with the second. The majority did not feel that ROTC's presence indicated that MIT supports disagreeable U.S. government policies. Finally, over 77% of the students believe that the ROTC option should be preserved for those who wish to choose it.

New undergraduates were more favorable towards ROTC than upperclassmen and graduate students by a small margin. Men were more receptive to its presence than women. A wider margin of disagreement was evident between foreign students who are not eligible to participate in the ROTC program, and U.S. citizens.

Comments

The ROTC student has obligations and restrictions which go beyond the general requirements. The courses in which he or she may major are limited. A concern regarding this was voiced by several faculty members. In the case of the AFROTC, the decision

as to the course program is made at the beginning of the freshman year, considerably earlier than the date for such a decision by the non-ROTC student. A request for a change in major can be denied. If a cadet leaves the program before graduation or is discharged from the program for disciplinary reasons, the cadet is obligated to serve two years as an enlisted person, possibly immediately on leaving the ROTC or upon leaving MIT. There are some restrictions on political activity of ROTC students by each of the services. Cadets are asked by the ROTC to observe the same restrictions on political activity as obeyed by a serving officer.

6) Student Career Choice

Mr. Robert Weatherall, director of the Office of Career Services and Preprofessional Advising, provided the Committee with analyses of the employment of MIT graduates in recent years, based on a questionnaire returned at graduation. Table B shows the percentage distribution by type of employer for the last four years. There is a decrease from 68% to nearly 60% (11% change) in the share employed by private firms or divisions of private firms, selling primarily to the commercial market, and this is a steady decline. Between the first and last years there is an increase from 22% to 27% (24% change) in the share employed by private firms, or divisions of private firms, working primarily on government contracts; most of this change occurred between the first and second year.

Table C compares salaries paid to graduating students joining firms selling to the commercial market and firms employed on government contracts in 1983-84. There are no statistically significant differences between the salaries in the two cases. The College Placement Salary Survey for 1984-85 also indicates very small differences in salary levels nationwide between areas likely to receive government contracts such as aerospace, and areas where this is not the case.

Ms. Candace Hopkins of the Alumni Center supplied the Committee with the number of alumni whose business addresses indicate that they are employed by the military or by organizations or firms working substantially on military contracts. Out of the pool of 57,000 alumni giving business addresses, 2822 (5%) were identified with such institutions; this is almost certainly a lower limit. In 1982, the NSF made a survey of the activities of scientists and engineers who were counted as in "science, engineering or related occupations in the 1980 Census. This showed that 13% were working on national defense. Since then, this share has almost certainly not fallen, and probably increased, judging by the growth in defense expenditures in relation to other Federal expenditures and G.N.P. Thus, the ≥5% figure for MIT alumni is surprisingly low. The figure for recent graduates correcting for the categories not listed in Table 1 (27.5%) and taking one-third of employment in government agencies and government funded laboratories and two-thirds of employment in firms working primarily on government contracts as defense-related, is 15%. Given the lack of uniformity in the definition of categories in the various sources, this is in approximate agreement with the NSF figure.

Table B

Destination of MIT graduates at all degree levels in science and engineering not taking strictly academic jobs or entering the military

(Source: Office of Career Services and Preprofessional Advising)

	1980-81	1981-82	1983-84	1984-85
Private firms, or divisions of private firms, selling primarily to a commercial market	68.0%	64.7%	62.9%	60.5%
Private firms, or divisions of private firms, working primarily on government contracts	21.6%	25.9%	26.4%	26.9%
Federally-funded laboratories (Lincoln Lab, Draper Lab, Sandia, etc.)	5.0%	3.1%	4.3%	5.5%
Government Agencies	3.8%	4.1%	3.7%	2.6%
Non-profit organizations (e.g. hospitals)	1.6%	2.2%	2.7%	4.5%
	100.0% N=504	100.0% N=456	100.0% N=375	100.0% N=506
Total number of graduates	1678	1801	1851	1819

Table C

Salaries paid to graduating students joining firms selling to a commercial market (A) and firms employed on government contracts (B), 1983-84

(Source: Office of Career Services and Preprofessional Advising)

		A	B
	25%	$26,500	$27,100
S.B.	Median	$28,000	$28,000
	75%	$28,800	$29,120
		N=100	N=36
	25%	$29,700	$30,900
S.M.	Median	$31,400	$31,800
	75%	$33,000	$33,000
		N=78	N=47
	25%	$36,000	$38,000
Ph.D.	Median	$40,000	$40,008
	75%	$40,000	$42,640
		N=35	N=13

7) SDI and MIT

The Strategic Defense Initiative, now two years old, promises to be the most rapidly growing research program within the DOD; its current budget is $2.76 B. The AAAS analysis cited in Section 4 anticipated growth in SDI spending and total DOD spending for research and development in constant dollars as follows:

	FY 86/85	FY 87/86
SDIO	92%	68%
DOD R&D Total	7%	20%

Within SDI, the establishment of an Innovative Science and Technology Office, SDIO/IST, specifically to fund university research was announced early last spring to a meeting of 250 academics held near Washington. In the words of its director, the Office would

(a) Pursue, from the scientific feasibility to the engineering proof-of-principle stage, highly innovative, high-risk concepts that could have a revolutionary impact upon the Strategic Defense Initiative.

(b) Mount a mission-oriented, basic research program that drives the cutting edge of the nation's science and engineering effort in a direction that supports existing SDI technological development thrusts and points the way for future initiatives.*

SDIO/IST expects to spend $70 million in 1986, and as much as $100 million plus 1% of the whole SDIO budget in later years.**

Two MIT faculty members attended the meeting and returned with a briefing document describing the process for submitting informal proposals, "white papers," which was then distributed to faculty members and research staff in the seventeen research areas in which SDIO/IST was offering support. Some faculty members questioned the appropriateness of participating in this research. Similar discussions and questions occurred at other universities. These events were subsequent to the faculty group's letter to the President that triggered this Committee's inquiry.

*SDIO, Innovative Science & Technology, University Review, 29 March, 1985, p. 3.

**The 1986 figure is given in Science, 19 March, 1985, p. 304; the estimate for later years in Physics Today, July, 1985, p. 55.

MIT students, through a petition to the administration and letters in the Tech, asked specifically for an examination of the appropriateness and effects of MIT participation in research supported by SDI. The President and Provost responded to these requests by, in effect, referring them to the Committee. Therefore, we have addressed the current level of research funded by SDI and its possible growth and faculty and student attitudes toward SDI funding and SDI.

At the SDIO/IST meeting, the director said, "It's probably something that's never been done, but this office is trying to sell something to Congress. If we can say that this fellow at MIT will bet money to do such and such, it's something real to sell. That in itself is innovative."*

This led President Gray to comment in his charge to the graduates at commencement last spring. "...We have recently learned that the SDI Program will fund basic research in universities, and that the funding of some ongoing research programs which are relevant to SDI may be shifted to that program. The head of the SDI's Office of Innovative Science and Technology has asserted that the participation of university researchers in SDI-funded projects will add prestige and credibility, and will influence the Congress to be more generous in funding for the program. The impact of this manipulative effort to garner implicit institutional endorsement for SDI comes with special force because of the controversial nature and the unresolved public policy aspects of SDI...

"What I find particularly troublesome about the SDI funding is the effort to short-circuit the debate and use MIT and other universities as political instruments in an attempt to obtain implicit institutional endorsement. This university will not be so used. Any participation at MIT in SDI-funded research should in no way be understood or used as an institutional endorsement of the SDI program. I have begun the process of communicating this view to appropriate persons in the government and will continue to do so."

Current Involvement

In response to our request on March 4, OSP provided the Committee with a list of proposals known to them for SDI funding submitted by on-campus research groups, and their funding status. Seventeen proposals are listed in all. Two are currently funded: one in the Plasma Fusion Center on "Substorms and Magnetic Tearing" for one year at $110K; one in the Materials Processing Center on "Processing and Evaluation of Metal and Ceramic Matrix

*Science, 19 April, 1985, p. 304.

Composites" for two years at $1.1 M/year.

Four proposals are listed as pending: one in the Chemistry Department for 19 months at $80K/year; one in the Plasma Fusion Center for 23 months at $162K/year; one in the Center for International Studies for 4.5 years at $112K/year; and one in the Aero/Astro Department for 10 months at $54K/year. These total $408K/year.

In addition, there are six new submissions, one in the Laboratory for Information and Decision Systems and five in the Plasma Fusion Center. All are for periods of three years or slightly more, and they request funds at the rate of $3.24M/year. Pending proposals and new submissions together indicate a potential for doubling or tripling present levels of SDI support.

Five proposals from the Plasma Fusion Center are listed as not funded: four requested funds over three or four years at an annual rate of $2.1M; the other was for a three-month period in the past. Two others, one from the Statistics Center and one from the AI Laboratory, requested funds for three and four years, at a combined annual rate of $2.42M, were also refused funding.

These figures should be compared with the $38.5M DOD funding of on-campus R&D in FY 1985 and the total on-campus budget of $236.7M.

Question 19 on the faculty questionnaire asked: "Are you or do you anticipate receiving SDI funding?" Eleven faculty members indicated that they are presently or will be shortly supported by SDI which again seems to indicate that the list of proposals known to OSP, involving only eight faculty members, is low. Another eleven indicated that they had submitted white papers which presumably may also be included with the six "new submissions." Given the response rate to the questionnaire of 45% overall, 49% in engineering, and 45% in science, these figures suggest that the OSP may not yet have caught up with all the proposals.

In addition to direct funding of on-campus research by SDI, approximately 25% of the total budget of Lincoln Laboratory came from SDI in FY 1985 (97% of this $274M budget was supported by DOD). This agrees with the $59.7M figure published in a November 1985 NY Times article* which placed MIT fourth in the list of SDI prime contractors, behind Boeing ($112M), TRW (84.3M), and Hughes Aircraft ($60.1M). Since Lincoln Laboratory

*"But Company Worries Grow," David E. Sanger, New York Times November 19, 1985.

paid MIT $5.5M in overhead for non-allocable costs* another $1.4M of SDI funding was in fact supporting general on-campus functions.

Faculty and Student Opinion

Question 20 on the faculty questionnaire asked: "What do you think of the effect of SDI funding on MIT?" Only 5% of those responding thought that the effect would be generally good. Thirty-nine percent thought that it would be generally bad, 23% thought that it would be neither good nor bad, and 32% were unsure. The largest percentage of the respondents from the School of Engineering thought that it would be neither good nor bad, whereas the largest percentages of those from the School of Science and those from the other Schools thought it would be bad.

Question 40 on the student questionnaire asked the same question. Again the largest percentage (33%) thought that SDI would be generally bad for MIT, fewer thought it would be neutral (13%) or were unsure (5%). More freshmen thought it would be good, but more of the students (25%) than was the case for the faculty thought it would be generally good, and fewer thought it would be good (34%) than bad (24%); there were no other systematic differences by academic year.

The rest of Q20 on the faculty questionnaire attempted to elicit respondents' reasons for their answers to the general question of the effect of SDI funding on MIT. Respondents divided approximately equally among "Agree," "Disagree," and "Unsure" to the statement: "The money will be a good source of research funding," with more from the School of Engineering agreeing and more from the School of Science disagreeing. The statement: "SDI should be accepted because it would enhance MIT's reputation as a leader in science and technology" elicited the strongest response with a majority disagreeing. To "SDI should be accepted because it will enhance the research and education functions at MIT in certain fields" the largest percentage responded "Disagree," and to "SDI funding should be avoided because it may impose changes in priorities in educational and research programs at MIT" and "SDI funding should be avoided because MIT funding should not be involved in weapons systems development" the largest percentage responded "Agree." There was strong agreement that "SDI funding should be avoided because of possible classification requirements and/or security restrictions," and an even stronger disagreement to the statement that "SDI funding should be avoided because MIT should not appear to support a politically controversial program." In general, the responses from the School of Engineering had smaller differences between "Agree" and "Disagree" than was true for the School of Science and other Schools.

*Lincoln Laboratory Review Committee Interim Report (2/24/85).

There was no directly comparable question on the student questionnaire, and it is thus not possible to sketch the reasons for the milder student opposition to SDI funding at MIT.

Question 21 on the faculty questionnaire asked for opinions concerning the technical feasibility of SDI. There was strong disagreement with the statement that the SDI would "probably make possible an effective nationwide defense against nuclear weapons," only %3 of the respondents agreeing, 74% disagreeing, and 24% responding "Unsure." There was also agreement (58%) that "It is unlikely to result in a useful defense system," but here there was a larger percentage of "Unsure" responses (30%), and the "Disagree" responses rose to 13%. On the statement, "It may yield a useful defense system of some kind" the responses were split approximately equally between "Agree," and "Unsure," and "Disagree," although the largest percentage responded "Disagree" in the School of Science and the other non-engineering Schools.

There was not a similar set of questions on the student questionnaire, but in Q41 a response was asked to the statement: "It (SDI) is probably technically unfeasible." Here 49% of all the students agreed, 29% were unsure, and 15% disagreed. The responses were quite different for the various years. Forty percent of the freshmen said "Unsure," 20% agreed, and 20% disagreed, while 53% of the graduate students agreed, 26% said "Unsure," and 14% disagreed. There was a smooth transition of percentages for the two intervening year groups.

The final question on the faculty questionnaire dealt with the strategic, economic, and political desirability of SDI. The largest percentages of the respondents disagreed with the statements that the SDI would be an asset to the U.S. strategic position (58%), would be a good bargaining chip (40%), would have a good effect on the economy (57%), and agreed with the statements that it would channel research away from the civilian economy (75%), would result in a "defense" weapons arms race (75%), and would escalate the "offensive" weapons arms race (66%). There were differences between the Schools, but the only significant one was that the respondents from the School of Engineering answered "Unsure" to the first three questions in significantly greater percentages (33%, 38%, and 37%) than those from the School of Science and other Schools (22%, 24% and 25%).

There were comparable questions in Q41 of the student questionnaire, and, except for the bargaining chip questions, the results were similar in that the largest percentage disagreed that the SDI would be an asset to the US strategic position (49%), and would have a positive effect on the economy (41%) and agreed that it would channel research away from the civilian

economy (52%), would result in a "defense" weapons arms race (43%), and would escalate the "offensive" weapons arms race (50%). However, the opposing points of view were represented by percentages that were 1.5 to 3 times greater than those for the faculty. On the question whether the SDI would be a good bargaining chip, 43% of the students agreed in contrast to 30% of the faculty, and 29% disagreed in contrast to 40% of the faculty.

Correlations among some questions on the faculty questionnaire were examined. Those who responded that they were indifferent to the task of the Committee or felt that the task was inappropriate, in general responded to Q20 through Q 22 with somewhat greater support for SDI. The 110 faculty members who indicated that they had DOD support responded to Q20 through Q22 in a manner not significantly different from that of the total sample. The 61 faculty members who had received or hoped to receive SDI funding understandably were more inclined to view SDI funding as either good for MIT (30%) or neutral (10%). But 18% were unsure, and 10% answered that the funding was bad for MIT. Finally, there was a positive correlation between those who thought SDI was technically unpromising and those who thought it bad for MIT, and also strategically, economically, or politically undesirable.

There was a question on the student questionnaire concerning the pledge not to accept support from SDI funds. One-third of the students responding support the pledge and said they will not do research for SDI, and 17% oppose the pledge because they are in favor of the SDI program. An additional 7.5% support it in principle but fear that by refusing SDI money they may harm careers or educational opportunities, and 11% disagree with the pledge campaign tactic although they are against SDI. There was no comparable question on the faculty questionnaire; comparison is possible with the numbers of faculty members who have already signed such a pledge: 38 in the School of Engineering (10% of the faculty); and 73 in the School of Science (27% of the faculty).

8) Summary Comments and Issues for Reflection and Discussion by the Faculty

Research support from the DOD and the military-related activities of the DOE and NASA are important to MIT, although that support is not the largest share of research support and has not been the most rapidly growing one over the last decade. Further, only a very small fraction* of the research so supported is directed to military applications. But the fact remains, MIT is and has been one of the largest defense contractors among universities for a decade.

Changes in Federal Government research priorities have already increased the relative importance of defense support, and this trend will continue in the near future. Further, funds from SDIO/IST will be increasing more rapidly than defense support as a whole.

A substantial minority of the faculty respondents to the questionnaire expressed concern over the effects of military funding on "restriction of publication, restriction of students' choice of major and changes in the direction of research." Two-thirds of the student respondents expressed some aversion to working on military projects. In general, students overestimated the importance of military funding at MIT; but student evaluation of the effect of this situation on the educational environment or on MIT more generally was widely spread along the negative-positive spectrum, with the largest group reporting themselves neutral or unsure. A majority of the students considered themselves ill-informed on the broad question of military influence on MIT, and, while a majority discuss it more than occasionally with their peers, they do so with advisors, other faculty and TAs only rarely. Further, students felt ill-informed on the importance of military work on various career fields, and three-quarters would welcome more information. Should not something be done to provide this information systematically?

Faculty and student opinions on the effect of SDI funding on MIT also spanned a wide spectrum; those who were unsure or thought the effects would be neutral formed the largest group

*A generous estimate might be 10-11%, taking all of the fraction of DOD, DOE, and NASA support categorized by respondents to the faculty questionnaire as for "specific military application," and half of that as for "applied research of broad general applications."

in the faculty; among students, those who thought it would be generally bad formed the largest group. But a much higher proportion of students than faculty expected good effects.

Anticipating the possibility of increased pressure for classification, security clearances for faculty and students, denial of access to research to non-citizens, the majority of the faculty expected to resist accepting such restrictions.

Only a very small fraction of the faculty (3%) believed that the SDI program would probably achieve its stated goal of an effective nation-wide defense against nuclear weapons, although substantial minorities thought it might well result in a useful defense of some kind.

A majority of the faculty also expressed concern about the broad economic effect of SDI; three-quarters felt it would further channel research funds into areas not related to the civilian economy.

The Committee was troubled by the restrictions on ROTC students' choice of field of study that the military services impose. Commitment before entry appears to us as especially undesirable. In our judgment, the present restrictions serve the interests of neither the students or the services. These policies are, of course, not local, but originate in Washington. Is this an issue the Institute can usefully address?

The Committee believes that the faculty should reflect on two broad questions in the light of the information presented in our report.

First, are our present policies [see Appendix E, pp. 1-3, for Section 4.12 of Policies and Procedures (1985) and a comment on their application] working well in respect to research: specifically, faculty initiative and freedom in securing research support, exclusion of classified research from the campus (with some few individually-granted exceptions), open publication of research results, opportunity for all qualified faculty members, research staff and students to participate in research without regard to citizenship? Can they be expected to continue to work well in the light of the anticipated changes in the national scene? How much will the continuing effort to increase non-governmental sources of research support help?

Second, are there special problems in the relationship between researcher and sponsor in the case of SDI?

> Should skepticism or downright disbelief in the technical feasibility of the stated objective of the program inhibit faculty from accepting support from SDIO for research that they believe is of scientific interest?
>
> Will plentiful funding lead to a softening of scientific standards in judging what is technically interesting and important?
>
> Will a tacit conspiracy of silence arise, in which funder and researcher agree to characterize what the researcher wishes to do anyway with labels acceptable to the funder? Such behavior has not been unknown in the past.
>
> Will the widespread acceptance of SDI funding result in the muting of public discussion of the program's merits by technically competent critics? (Appendix E, p.4 has recent statements by the Undersecretary of Defense for Research and Engineering that are particularly troubling in this connection.)

Finally, are these questions to be answered entirely or chiefly by individual faculty members on an individual basis, or do they require attention by the Institute?

A cautionary note

The Committee has assembled a mass of diverse information from a variety of sources. The inevitable lags in gathering and publishing information mean that much of it is not as current as would be desirable. The Committee has sorted, sifted, and compressed these materials, and summarized them in necessarily imprecise prose. The emphasis, tone, and balance of the result are a matter of compromise; different ones among us might have used different adjectives or adverbs, selected different items from the appendices to summarize in the text or made a different interpretation of one or another datum.

The final result is one we all accept, but only with the caveat stated.

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Carl Kaysen, Chair
James L. Kirtley, Jr.
Vera Kistiakowsky
Louisa Koch
James R. Melcher
Daniel O'Day
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