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Getting Serious About the Engineering and Science Pipelines

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Speeches of Richard M. Freeland

Address at an Executive Conference: "Getting Serious About the Engineering and Science Pipeline"

EMC Corp., Hopkinton, Mass.

May 27, 2003

NOTE: This speech is accompanied by a PowerPoint presentation. Clicking on the slides will open a new window.

I am delighted to have this opportunity to address a topic of great importance to our state, our economy and our institutions of higher education. It is a special pleasure to do so here at EMC, with whom Northeastern has enjoyed close relationships since its founding in 1979 by Northeastern graduates Dick Egan and Roger Marino. So I thank President Joe Tucci and Chairman Mike Reutgers, along with my colleagues from the University of Massachusetts and our other sponsors, for supporting this conference, and I thank Gov. Mitt Romney for taking the time to share his thoughts with us today.

My role this morning is to outline the challenges we face in assuring a healthy supply of skilled workers to sustain the high tech sector of our economy. In discussing this so-called pipeline issue, I will focus on the physical sciences, engineering, mathematics and information technology — the so-called SEIT fields — putting aside the emerging field of biotechnology, which presents a different set of conditions. I will also focus on the pipeline issue as it relates to young Americans as distinct from the talent represented by our immigrant community.

I will structure my remarks around two broad themes that have been associated with the pipeline problem for at least two decades: first, the decreasing interest of young people in careers in SEIT fields, both in Massachusetts and nationally; second, some specific characteristics of the regional economy that make the pipeline challenge especially difficult. In addition, I will suggest that the ongoing globalization of labor markets may make the pipeline issue even more difficult in the future than it has been in the past.

Student Participation in SEIT Fields

To begin with, the most basic challenge of the SEIT pipeline: It is widely understood that American students, both nationally and in Massachusetts, have in recent years exhibited far less interest in the academic disciplines that lead to employment in high-tech fields than was true in the past and is true in many other countries.

[Click [here](#) to see slide] Between 1990 and 2000, in fact, while the number of bachelor's degrees granted in the nation rose by 18 percent, the number of degrees in engineering, information technology and the physical sciences actually declined. A similar — indeed, even more dramatic — shift away from SEIT fields was apparent in Massachusetts, a point to which I shall return in a few moments. For now, however, let us concentrate on a number of trends that are generally consistent both nationally and in our region.

[Click [here](#) to see slide] One such arena is graduate education, where the number of technical degrees granted to native-born students has declined at both the master's and doctoral levels over the past 10 years, a fact that clearly reflects the movement away from SEIT majors among undergraduates.

Against this overall pattern, we must overlay two additional factors. The first is the changing ethnic composition of the youth population; the second is the widening gender imbalance among college students.

[Click [here](#) to see slide] Findings from the 2000 decennial census reveal rapid growth in the commonwealth's Asian and Hispanic populations, moderate growth among African-Americans and a declining white population. These demographics are heavily influenced by the surge in immigration that Joe Tucci mentioned earlier.

As population growth varies among ethnic groups, the math proficiencies vary as well. Colleges and universities generally identify students who score at least 620 on the Math SAT-1 test as potential candidates for SEIT majors.

[Click [here](#) to see slide] Here, we can see that, with the exception of Asian-Americans, population shifts will tend to reduce applicants in math- and science-related fields.

[Click [here](#) to see slide] The widening gender imbalance in our college-going population is also having an impact. For some time now, the number of women going to college has been growing faster than the number of men, and today the commonwealth is granting about 130 degrees to women for every 100 granted to men. When it comes to math proficiencies, however, only 15 percent of women scored 620 on the Math SAT-1 in 2000, compared to 25 percent of men. And the limited number of women with strong math SAT scores are generally less likely to enter a technology field than are their male counterparts.

Given these shifts in the profile of college-going students, our efforts to rebuild our technical labor market pipeline must pay particular attention to women and minorities. But these important considerations should not divert attention from the most important fact of all, which is the fundamental weakness of interest among young people in SEIT careers.

[Click [here](#) to see slide] The fact is that even with the demographic changes I have noted, in the year 2000 more than 10,000 students in the commonwealth scored 620 or above on the math SAT — more than one out of every five college-bound seniors. The problem is that only one-fifth of these well-prepared test-takers intended to study a technical field in college. In a nutshell, here we have a set of fields in the physical sciences, mathematics, engineering and information technology that, in the 1990s, offered graduates high earnings potential and exceptional growth prospects and that were central to the New England economy, yet at the end of the decade only two out of 10 of our brightest high school graduates were interested in pursuing them.

As we acknowledge the deep and persistent lack of interest among young Americans in SEIT fields, we need to understand, also, that this issue has been widely recognized for a number of years, and that millions of governmental dollars have been spent in efforts to turn this around, with little evident impact so far. I am sure that the discussion this morning will explore these challenges in more detail, and I look forward to the contributions of all our distinguished contributors.

The Impact of Regional Economics

Let me now turn to a second aspect of the pipeline issue, which has particular salience for Massachusetts. In this connection, we need to contemplate more carefully the surprising fact to which I referred earlier: that the recent decline of student interest in SEIT fields is even more pronounced in Massachusetts than it is in the rest of the nation. Thus, at the same time that our economy is more dependent for growth on high-tech fields than other parts of the country, our young people are showing a heightened aversion to these fields. Even among technology oriented regions, the comparisons are ominous.

Looking across all states with heavy concentrations of high-tech industry, we rank last in the percentage of college-going high school graduates intending to major in SEIT fields. We have to ask ourselves why. Part of the answer may lie in the particular character of our economy as it has evolved in recent years and as young people growing up in Massachusetts have experienced it.

[Click [here](#) to see slide] Over the past two decades, Massachusetts has developed an extraordinary degree of cyclical volatility. The rapid expansion of the 1980s was followed in the early 1990s by the worst recession since the Great Depression. We lost 11 percent of our jobs and led the nation in job loss.

In the second half of the 1990s, Massachusetts experienced a tremendous period of job creation. Labor shortages became widespread, especially in SEIT fields, and these shortages became a significant constraint on further economic growth and new job creation. More recently, of course, the collapse in national equities markets initiated a sustained period of retrenchment. The impact on the job market has been dramatic. We have lost nearly 170,000 jobs over the past two years — one in 20 jobs — and again lead the nation in the rate of job loss.

Cyclical volatility is not unique to Massachusetts. It appears to characterize other regional economies that are dependent on technological innovations as engines of growth. As the statistics I have just summarized make clear, however, the pattern here has been particularly severe.

Understanding how high-tech workers are adjusting to the current recession is critical to our discussion of the future labor market pipeline. **[Click [here](#) to see slide]** One response has been a shift toward contingent or contract work as many laid-off professionals convert themselves into part-time consultants and try to wait out the economic storm. Some of this cohort should be available to return to technical fields when the economy rebounds.

The second way many unemployed professionals are adjusting to the economy is much more problematic. We are once again experiencing a sharp rise in migration. Last year, 28,000 more people left the state than moved in, including many young, well-educated workers who became discouraged about their prospects in Massachusetts. This is a level of resident departure that we have not seen since the early 1990s.

In a state where the labor force is nearly stagnant, we simply cannot afford losses of this magnitude. The impact of labor market volatility on the attitudes of young people toward SEIT fields is also very troublesome, and takes three primary forms:

- It drives college-bound students away from technical fields of study.

- It encourages recent graduates to move to other parts of the nation.

- And it forces recent college graduates to take jobs outside of the college labor market, and thus begin their careers on the wrong track.

These are exactly the same set of factors that contributed so importantly to the slow labor-force growth and resultant labor shortages of the 1990s. So here is the second issue I would put before this conference: Clearly the labor markets for high-tech workers are sending cautionary signals to young people contemplating their possibilities in the economy of the region. Are there things we can do — though corporate policies, through government initiatives, though educational programs — to modify these messages and smooth out the impact of these

sharp cyclical shifts?

So far in these comments, I have focused on two aspects of the pipeline issue as we came to understand it during the 1990s: one having to do with students — their inclinations, their skills, their changing demographics — the other having to do with and regional economic characteristics. Both matters need to be addressed if we are to avoid a repeat of the mismatch between the availability of appropriately skilled workers and the needs of industry when the economy begins to grow again. In the final part of my remarks, I would like to add another set of issues for consideration by the conference, and in so doing to suggest that the structure of our labor market may have changed in ways that could easily exacerbate the pipeline problem in SEIT fields.

I refer to the explosive phenomenon of globalization. It is well understood that during the 1990s many of our major high-tech companies became increasingly global in their operations through the establishment of facilities in other countries and through partnerships with overseas companies. This pattern of expansion taught us that our companies could compete effectively in markets around the world, and it also taught us that high-quality products can often be produced overseas at lower costs than can be achieved in Massachusetts.

This fact creates the future possibility that major high-tech companies will consider expansion abroad as an alternative to expansion here at home in response to revived domestic economic growth and increased demand for products. If this occurs, then our students will increasingly compete for jobs not just with other young residents of Massachusetts, but with their counterparts in India or Ireland or China or Mexico. And if all this occurs, may it not add yet another reason for young people to be wary about committing their lives to SEIT fields? This is the third issue I would put before this conference: Has globalization brought about fundamental changes in the structure of our labor market for SEIT workers, and, if so, how will these changes effect the pipeline issues that are the focus of our discussions?

[Click [here](#) to see slide] I realize that my remarks this morning have raised questions rather than answered them. My purpose has been to put before the conference a layered set of issues that, taken together, have a cumulative and highly worrisome impact on the pipeline of young people preparing for careers in SEIT fields.

To summarize briefly: We begin with the underlying challenge that in recent years, young Americans have shown a declining interest in math, science and technology. We add the fact that demographic change in the college-going population is likely to further erode the inclination of students to study SEIT fields. We then must add that these national trends are greatly exacerbated in Massachusetts. And finally we must reflect on whether the challenge of interesting our young people in SEIT fields will be made more difficult by globalization. This is a daunting set of challenges for today's conference and for our state. Yet our future prosperity, and therefore the well-being of our children,

depends upon our ability to address them.

Our discussions today occur in the context of a remarkable history. In the years since World War II, scientific and engineering innovation has fostered some of the world's most successful companies and enabled a great many Massachusetts residents to achieve a high standard of living. That prosperity has rested on the sturdy foundation of a labor force that has included large numbers of gifted young people with high skill levels in SEIT fields.

How to preserve that foundation is the great question before us this morning. It is my firm belief that effective answers will require a collaborative effort by higher education, the high-tech industry and government. Past collaboration among these partners has produced remarkable successes of which we are rightly proud. Let us work together now to assure for future generations what our generation has experienced: our commonwealth as a world leader in innovation and a place of opportunity. I pledge to you today Northeastern University's commitment to that noble end.

Thank you.

NOTE: This address was followed by other speakers and two panels focusing on policy and best practices related to the SEIT labor-market pipeline.











