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Pay and Rank of Female Engineers in Government Service:

A Crack in the Glass Ceiling

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Abstract

In 1991, the United States government began efforts to address the "glass ceiling" and its effects on the federal workforce. This article explores the nature of the glass ceiling, particularly progress made since 1991 on the pay status and hierarchical placement of the almost 200,000 engineers in United States federal civilian employment. When a glass ceiling exists, men occupy a disproportionately high percentage of the higher ranks in a career field, while women tend to be overrepresented in its lower ranks. Similarly, on average men earn higher pay than women in the same organizational rank. These were exactly the conditions of the federal engineering field in 1991, the year of the passage of the Civil Rights Act of 1991 that addressed the glass ceiling, among other topics. In 1991, as a result of the existence of the glass ceiling, women engineers earned only about 81% of the salaries and wages of their male counterparts. Through an exploration of federal employment databases, this article suggests that the condition of women engineers in government service has improved in the years since 1991—more female engineers are on the government rolls, they make up a much larger proportion of senior engineering management, and their compensation is much closer to parity with men—but they are not yet equal with males on any of these dimensions.

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A Reflection

Welcome to your new career! You are fresh out of a top engineering program and today is your first day at work. You have separated yourself from your fellow applicants, survived the hiring process, and now you are on your way to your new office on the third floor.

While waiting for the elevator, you observe that the architect did a terrific job of designing an impressive building. All the floors surround a central atrium; it stretches to the roof some 20 stories above the lush gardens on the ground floor. On each level, you can see people walking, talking, or just leaning on the balcony railings and you begin to notice some patterns. On the lower floors, you see men and women of all races and of all ages. By the middle floors, that composition has changed; you see fewer women and fewer minorities. By the time you focus on the highest floors, almost all the people you see, as well as those streaking toward them in the glass elevators, seem to look alike: they are male, and nearly all of them are white. Your elevator arrives and you enter it with your new co-workers to begin your ascent.

Your reaction to this little vignette depends a lot on you and on your experience. For some, such observations are not surprising, rather, they are an approximation of the way the working world is, and the way it always has been. Others, though, see this scene differently. They acknowledge the reality of a more homogeneous workforce at the top of the organizational hierarchy, but deny its inevitability. *Yes*, it may have always been this way, but *no*, it need not be this way in the future.

The office building is, of course, a metaphor for organizational life, one aspect of which is the glass ceiling: the invisible barrier and mechanism that results in the top levels of organizations and career fields being dominated by white males (Hymowitz & Schellhardt, 1986).

This article explores the nature of the glass ceiling and gender equality in general, and particularly the hierarchical and pay status of thousands of federally employed women in engineering. We examine the condition of the United States federal civilian engineering workforce at the time of the establishment of the Federal Glass Ceiling Commission (FGCC) in 1991. We compare hierarchical ranks and salaries of those engineers, by gender, to understand the status of men and women as of the FGCC's creation. Then, we analyze the corresponding data for the workforce as of 2003 to determine the extent of the progress made toward a more gender-equitable workforce.

Two Brief History Lessons

Lesson One: Historically, in the private sector, women have received less pay than men. As cited by Milkovich and Newman (2005), the pay policy handbook for a major US corporation in 1939 offered a rationale for this discrepancy, explaining that women should be paid less than men

> . . . because of the more transient character of the former [women], the relative shortness of their activity in industry, the differences in environment required, the extra services that must be provided, overtime limitations, extra help needed for the occasional heavy work, and . . . general sociological factors . . . . Basically then we have another wage curve . . . for women below and not parallel with the men's curve. (Electrical Workers (IUE) v. Westinghouse Electric Corp., 1980, cited in Milkovich & Newman, 2005).

Lesson Two: The Equal Pay Act of 1963 amended the Fair Labor Standards Act of 1938 and prohibited wage discrimination under two principal conditions: where employees perform equal work in the same establishment, or where employees perform work requiring equal skill, effort, and responsibility under similar working conditions (Equal Pay Act of 1963). Pay differences between men and women performing equal work were allowed under the act when pay was pursuant to seniority, merit, quantity or quality of production, or any factor other than sex. When passed originally, federal civilian employees were exempt from coverage. Today, they are covered.

A Barrier Invisible and Impenetrable

Occasionally, a new term resonates with the public in such a way that it quickly becomes part of everyday language. Two *Wall Street Journal* reporters, Carol Hymowitz and Timothy D. Schellhardt, created just such an effect in a 1986 article: "Even those few women who rose steadily through the ranks eventually crashed into an invisible barrier. The executive suite seemed within their grasp, but they just couldn't break through the glass ceiling" (Hymowitz & Schellhardt, 1986).

It was through their usage that the term "glass ceiling" entered the American lexicon, and, within five years, the law as well. The Civil Rights Act of 1991 established the Federal Glass Ceiling Commission (FGCC) whose mission was ". . . to focus attention on, and complete a study relating to, the existence of artificial barriers to the advancement of women and minorities in the workplace, and to make recommendations for overcoming such barriers" (The Civil Rights Act of 1991).

For four years, the FGCC studied employment conditions in the private and public sectors, and determined that gender inequity existed in both spheres. The federal workforce itself was certainly not immune. For example, in 1990, the year prior to the establishment of the Commission, only 6.2% of federally employed women were at or above the level of middle management (GS-13 and above). Yet males were four times more likely to reach those upper levels: nearly 28% of federally-employed men were in the GS-13 and above category (Federal Glass Ceiling Commission, 1995, p.35).

The General Pay Schedule for Civilian Federal Employees

At this point some words of explanation are called for. Most of the 1.7 million civilian federal white collar employees are paid based on what is known as the "General Schedule" (GS). The GS structure is made up of 15 grade levels, from the lowest (GS-1) to the highest (GS-15). Within each grade are ten "steps" upon which incremental pay increases are based largely, though not completely, on longevity (United States Code Title 5, §5332, July 3, 2001). Above GS-15, special pay plans exist for the highest levels of management (e.g., the Senior Executive Service or the Senior Diplomatic Service). As a rough comparison, a GS-12 is similar in organizational level to an Army or Air Force captain, and a GS-15 is approximately equivalent to a colonel. The highest levels of civilian leadership (those senior leaders above the General Schedule) are considered parallel to generals and admirals in the military.

In 1991, the mean GS grade for all federally-employed women was GS-7.50; their median grade was GS-7. For men, the mean was GS-10.38; their median grade was GS-11. Not surprisingly, this disparity was reflected in average salary. In 1991, the average federally-employed woman earned $28,184 annually, approximately two-thirds of the average $40,926 earned by a federally-employed man (United States Department of Commerce [USDC], 1991, p. 9).

The FGCC existed from its creation in 1991 until it released its final report in 1995. That report, "A Solid Investment: Making Full Use of the Nation's Human Capital," called on both the private sector and the government to reduce and ultimately eliminate the pernicious effects of the glass ceiling. The report urged the federal government to focus on two areas. First, the government should gather and disseminate national statistics to identify problem areas and to track improvement. Second, and equally important, the FGCC urged government at all levels to "lead by example," tearing down its own barriers to the professional success of minorities and women (Federal Glass Ceiling Commission, 1995, p. 4). Specifically, the report recommended that government units should ". . . increase their efforts to eliminate internal glass ceilings by examining their practices for promoting qualified minorities and women to senior management and decisionmaking [sic] positions" (Federal Glass Ceiling Commission, 1995, p. 35).

Engineering Career Fields in the Federal Government

There are 446 white collar career fields within the federal government. Of those, 32 are within the category known as GS-0800, covering engineering, architecture, and related fields. In 1991, at the beginning of our study, these 32 engineering-related specialties contained 187,623 people, about 11% of the total federal civilian workforce. (USDC, 1991, p. 118-119).

A Societal Context

There can be little disagreement that women are underrepresented and underpaid in scientific and engineering fields. But the reasons promulgated for this status generate a great deal of contention.

A recent report from the Society for Human Resources Management (SHRM) has identified four reasons why disparities may exist generally in pay and advancement opportunity for women versus men. First, hitting the issues head-on, "A major sign of the effect of the glass ceiling is gender-based compensation" (SHRM, 2004, p. 3). Second, corporate cultures hamper women's advancement. Third, challenges in balancing work/life concerns inhibit women's advancement. Finally, an organization's culturally engrained mentoring and networks favor men (SHRM, 2004).

Some see the seeds of disparity as being sown early. While young males are guided toward science and mathematics, young females are steered toward softer studies. Some even espouse the view that women are neither intellectually nor temperamentally suited for quantitative work:

If women were still being discriminated against in engineering school, or in high schools, I could understand it. However, there is no evidence of such discrimination. If relatively few women are going into engineering, it is probably because fewer women have aptitude for or interest in the work. (Borger, 2003, p. 8)

This point of view set off a firestorm of controversy when offered in remarks by Lawrence H. Summers, President of Harvard University, to members of the National Bureau of Economic Research (NBER) (Winters & Kelly, 2005). Although Summers subsequently professed his ". . . strong commitment to the advancement of women in science . . ." (Summers, 2005a), a transcript of his remarks made five days earlier offered three hypotheses as to why women are underrepresented in scientific and engineering fields: (1) they are unwilling to work long hours (e.g., 80-hour weeks) because they value family more than men do; (2) women are inherently (genetically) worse at science than are men; and, (3) women are more susceptible to different socialization patterns and patterns of discrimination than are men (Summers, 2005b).

With respect to the contemporary dialog about genetic differences between men and women, Silva has noted,

. . . discourses of genetics as the fundamental basis for individuality, identity, or uniqueness are . . . widespread . . . . The appeal of genetic individuality certainly lies, at least partially, in the idea that there is something stable, something assured, something that (with the right tools at least) we can "see" and "know" that makes us who we are. . . . Science has succeeded in . . . fixing for all time our ability to know and guarantee who and what we are. (Silva, 2005, p.107)

The above assertions and hypotheses notwithstanding, there is ample evidence that higher education's approach to engineering is less than ideal. While the percentage of undergraduate female engineering students has climbed modestly over the past two decades, statistics make clear that they are substantially more likely than males to drop out of the engineering profession (Peters, Lane, Reese, & Samuels, 2002). Indeed, even Summers (2005b), in his remarks to the NBER, acknowledged anecdotally that although there were ". . . very substantial increases . . ." in female graduate students in science and engineering 20-25 years ago, there is no evidence that a high ratio of females to males has been maintained when one looks today at the highest levels of an organization (para. 3). Far fewer women today are in their organization's highest ranking science and engineering positions than one would have predicted from graduate student enrollments in those fields 20-25 years ago (Summers, 2005b).

One reason for this disparity may be that female engineering students lack role models among their teachers. The United States Department of Education figures from 1995 reveal that only 3% of engineering professors at that time were female. That small band of women often felt marginalized, reporting disrespectful behavior from other students and unsupportive attitudes from peers and administrators (Murray, Meinholdt, & Bergman, 1999).

Furthermore, curriculum design and pedagogical style may also hamper women's chances for success in engineering. For example, engineering programs are often oriented toward a "weeding out" process, carried out through a heavy emphasis on competition among students. This may have a disproportionately negative effect on female students, who tend to gravitate more toward learning styles emphasizing cooperation and collaboration, and less toward learning styles emphasizing competition (Murray, et al., 1999).

Still, the number of women graduating with baccalaureate degrees in engineering climbed from a miniscule 1.6% in 1974 to 14.8% in 1994. However, researchers suggest that those encouraging numbers only mask a deeper set of problems. Researchers of engineering and other male-dominated professions make clear the existence of a revolving door through which large numbers of women may be admitted to the career field, only to be shown to the exits in short order (Chang, 2003).

These concerns are shared by organizations at the pinnacle of the scientific and engineering world. The National Science Foundation awarded a $19 million grant to study recruitment and retention of women in technical careers (Rosser, 2003). And nine of America's most prestigious research universities have acknowledged, in a first-of-its-kind statement, the existence of institutional barriers for women in scientific and engineering careers (Rosser, 2003).

While these studies have targeted non-federally employed engineers, there is reason to believe that similar conditions and prejudices exist in the federal workforce. While the glass ceiling itself may be invisible, its effects are not. If such a barrier exists within the federal government, one would expect to find women disproportionately clustered on lower rungs of the career ladder, with incomes correspondingly lower than those of their male counterparts. However, if the progress urged by the Civil Rights Act of 1991 and the recommendations of the Federal Glass Ceiling Commission in 1995 have in fact become a reality, one would expect to see statistical progress in the years since 1991, in terms of both pay and upward career mobility and success.

A Retrospective: Federal Engineering Career Fields in 1991

To best evaluate the extent of progress made in eliminating the glass ceiling, we will begin by examining the state of federal civilian engineering career fields in the early 1990s. Of the government's 1.7 million white-collar employees in 1991, about 841,000 (or 49.1%) were women. Yet in 1991, women made up only 8.1% of the federal civilian engineering workforce.

One significant measure of gender equity is salary. In 1991, male federal employees in engineering earned substantially more pay, in the aggregate, than did their female counterparts. The average salary for federally-employed male engineers was $45,900 in 1991, and for women, $37,400. Thus, the average woman engineer earned only about 81.4% of the salary earned by the average male in the field (USDC, 1991, p. 38).

Since GS pay scales in government do not vary based on gender, one must look elsewhere for the causes of this substantial disparity. Some likely causes are rank and seniority. With such a significant gender-based difference in earnings, one would expect to find that engineering fields were, in 1991, characterized by disproportionately high numbers of men at the upper levels, with women overrepresented in the lower ranks. Table1 shows that compared to their overall representation of 8.1% in the federal

engineering workforce, women were *over*represented in lower ranks (at or below the level of GS-13), and severely *under*represented above that level: less than 3% of all federally employed engineers above the level of GS-13 were female.

The underrepresentation of women was even more evident at the highest pay levels. In the most senior pay grades, comprised of those senior executives compensated above the GS-15 level, female engineers held a mere 22 of 1,328 positions, only about 1.7% (USDC, 1991, pp. 70 – 71).

All of the numbers discussed above suggest that female engineers within the federal government faced a pronounced glass ceiling effect in 1991. Salaries in all engineering subspecialties showed substantial inequity and the highest-ranking levels of the field were very much a male preserve, with women filling less than two percent of those positions.

That same year, however, marked the passage of the Civil Rights Act of 1991 and the establishment of the FGCC. Has the status of women engineers improved in the years since? Has pay equity been achieved, or at least improved? Are women better represented today at the upper levels of engineering fields? For these answers, one must turn to the most recent federal employment statistics.

Women in Federal Engineering Careers—2003

If the above data show engineering fields with a strong glass ceiling at the start of the 1990s, how had the picture changed by mid-2003? To answer this question, it is necessary to evaluate the most recent data available, covering the federal workforce as of June 2003. An exploration of federal employment databases developed by the United States Office of Personnel Management reveals substantial improvement in the status of women engineers between 1991 and 2003.

From 1991 to 2003, the size of the government's engineering workforce dropped significantly due to the impacts of retirements, outsourcing of government work to engineers in private industry, and other economic factors. At the same time, women as a proportion of the federal civilian engineering workforce climbed by half, from 8.1% in 1991 to 12.2% in 2003. Comparatively, in the same year, women engineers represented 9.8% of the private sector workforce in the so-called "nontraditional occupations for women" in the fields of aeronautical engineer, computer hardware engineer, civil engineer, electrical and electronic engineer, industrial engineer, mechanical engineer, and engineers (all other) (United States Department of Labor, [USDL], 2004).

Meanwhile, shortages of engineers drove private sector salaries higher, while government pay lagged significantly. The average nationwide salary of all government engineering employees in June 2003 was $74,528 (United States Office of Personnel Management, 2003). But the financial picture was brighter in the private sector, where compensation for engineers was substantially higher (National Society of Professional Engineers, 2003).

Although the size of the total federal engineering corps declined between 1991 and 2003, today the prospects for women engineers have never been better. We saw that in 1991, women engineers' average salary was just 81.4% of their male counterparts. By mid-2003 that proportion climbed to 90.7%. In federal service, the average woman engineer's salary was $68,347, the average man's $75,385.

Similar success can be seen in promotion of women into senior management positions. Table 2 shows how male domination of senior General Schedule ranks has

faded. In 1991, only 2.8% of engineers at the senior ranks of GS-14 and GS-15 were women. By 2003, that percentage had increased nearly four-fold to 10.2% (United States Office of Personnel Management, 2003).

At even higher levels, above the General Schedule, the progress is even more dramatic. As shown in Table 3, the number of males eligible for special pay plans such

as those found in the Senior Executive Service (equivalent to military generals and admirals) dropped sharply from 1991 to 2003, paralleling the decline in the overall engineering workforce. But note also that the number of women eligible for these special pay plans more than tripled, from 22 to 71, during the same period. Looked at on a percentage basis, the progress is even more dramatic. In 1991, women made up only 1.7% of the most senior executives. By 2003, that percentage had grown by almost six times, to 9.7% (United States Office of Personnel Management, 2003).

Summary, Discussion, and Conclusions

This research describes the pay status and advancement progress of women in the federal government's engineering career fields. While it is apparent that the 12 years between 1991 and 2003 brought significant percentage advancement for women engineers, one must look behind the numbers to see if true progress has been made. Statistically, when starting with a set of relatively small numbers, almost any improvement can appear as dramatically significant. Such is the case here—despite some progress, women in engineering fields in federal government service are still outnumbered by men 9:1, and they still receive less pay than men for comparable work.

One optimistic view of our analysis would suggest that the present snapshot documents a stage in the inexorable journey of women toward gender equity at work. But those with less rosy perspectives can find ample room for concern. Is it possible, for example, that the influx of women into the career field, which increased the proportion of women from 8% to 12% in just over a decade was merely a result of the strong 1990s economy drawing more men to the higher pay of the private sector? Is it even possible that engineering within federal employment will be increasingly seen as "woman's work," subject to the social, economic, and cultural biases that have historically been implicit in such a designation? Until the societal dialogue becomes less acrimonious and more thoughtful and accepting, the causes of the progress, or lack thereof, made by women since 1991 will remain unclear.

Even so, for women aspiring to careers as federally employed civilian engineers, the news herein is promising. We would not be so naïve as to say that the glass ceiling has been shattered. However, one might contend reasonably that it is cracking, but not fast enough. Women have made progress at moving into federal engineering careers, especially into positions of upper management and senior leadership beyond the GS-15 level. Their increasing numbers and increasingly more equitable pay are reflective of that movement. From such positions in the hierarchy, it is realistic to expect that these women can, and in many instances will, extend a helping hand to those following behind them, and allow the entire engineering workforce to move in the direction of gender equity with respect to pay and organizational level.

Further, it is altogether reasonable to believe that gender equity in pay and opportunity for women will evolve through a combination of education, high organizational level sustenance, alteration of the federal government's culture and norms, and overt organizational acknowledgement that women represent an indispensable pool of leadership talent.

References

Borger, H. (2003). Gender benders [letter to the editor]. *Mechanical Engineering, 9*, 8.

Chang, T. F. H. (2003). A social psychological model of women's gender-typed occupational mobility. *Career Development International,8*(1), 27-39.

Equal Pay Act of 1963. (1963, June 10). Public Law 88-38, 29 USC 206(d).

Federal Glass Ceiling Commission. (1995, November). *A solid investment: Making full use of the nation's human capital* (Final Report of the Commisison). U.S. Washington, DC: U.S. Government Printing Office.

Hymowitz, C., & Schellhardt, T. D. (1986). Why women can't seem to break the invisible barrier that blocks them from the top jobs. *The Wall Street Journal*, A Special Report: The Corporate Woman, CCVII(57), pp. D1, D4-5.

Milkovich, G. T., & Newman, J. M. (2005). *Compensation*. New York: McGraw-Hill/Irwin.

Murray, S. L., Meinholdt, D., & Bergman, L. S. (1999). Addressing gender issues in the engineering classroom. *Feminist Teacher, 12*(3), 169-183.

National Society of Professional Engineers. (2003, September 10). *Income and salary survey report*. Retrieved February 11, 2004, from http://www.azspe.org/azdesigns/

Peters, J., Lane, N., Reese, T., & Samuels, G. (2002). *SET fair: A report on women in science, engineering, and technology from the Baroness Greenfield CBE to the Secretary of State for trade and industry.* Retrieved December 15, 2004, from www.dti.gov.uk/

Rosser, S. V. (2003, July/August). Attracting and retaining women in science and engineering. *Academe*, *89*(4), 24-28. Retrieved October 31, 2003, from http://search.epnet.com/login.aspx?direct=true&db=aph&an=10444860

Silva, V. T. (2005). In the beginning was the gene: The hegemony of genetic thinking in contemporary culture. *Communication Theory,15*(1), 100-123.

Society for Human Resources Management. (2004, June). The glass ceiling: Domestic and international perspectives, *2004 SHRM Research Quarterly*, 1-8.

Summers, L. H. (2005a, January 19). *Letter from President Summers on women and science*. Retrieved February 22, 2005, from Harvard University, The Office of the President Web Site: www.president.harvard.edu/speeches/2005/womensci.html

Summers, L. H. (2005b, January 14). *Remarks at NBER conference on diversifying the science & engineering workforce*. Retrieved February 22, 2005, from Harvard University, The Office of the President Web Site: www.president.harvard.edu/speeches/2005/nber/html

The Civil Rights Act of 1991. (1991, November 21). Public Law 102-166, 42 USC 722.

U.S. Code, 5 USC 5332. (2001, July 3). Retrieved February 22, 2005, from http://www4.law.cornell.edu/uscode/5/5332.html

U.S. Department of Commerce. (1991). *Occupations of federal white-collar and blue-collar workers. Federal civilian workforce statistics as of September 1991*. Washington, DC: Office of Personnel Management.

U.S. Department of Labor. (2004). *Nontraditional occupations for women in 2003*. Retrieved February 22, 2005, from www.dol.gov/wb

U.S. Office of Personnel Management. (2003, September). Fedscope: *Federal human resource database*. Retrieved December 15, 2003, from http://www.fedscope.opm.gov/employment.htm

Winters, R., & Kelly, M. (2005). Harvard's crimson face. *Time*, *165*(5), 36-38.

Table 1

Federal General Schedule-and-Related Engineers, by Level and by Gender, FY 1991

	£ GS-13	£ GS-13	[3] GS-14	[3] GS-14
Gender	Number	Percentage	Number	Percentage
Male	146,786	91.0	25,561	97.2
Female	14,543	9.0	733	2.8
Total	161,329	100.0	26,294	100.0

Table 2

Federal General Schedule-and-Related Engineering Employees, by Gender, Showing Percentage Change from 1991 to 2003

	£ GS-13		[3] GS-14	
Gender	1991	2003	1991	2003
Male	91.0	91.4	97.2	89.8
Female	9.0	8.6	2.8	10.2
Total	100.0	100.0	100.0	100.0

Table 3

Senior Engineer Executives (Above GS-15) by Gender, Numbers, and Percentages

Gender	1991		2003	
Male	1306	98.3%	664	90.3%

Female	22	1.7%	71	9.7%
Total	1328	100.0%	735	100.0%

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