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Disparities Between Perceptions and the True Nature of Engineering Education*

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Engineering curricula at the nation's universities, once were sufficiently distinct to have little overlap beyond the core curriculum. As a result, recruiters in days past could be reasonably sure of the courses in a graduate's transcript, by differentiating by bachelor's degrees. Over time, however, interdisciplinary research succeeded in showing how knowledge and methodology, once exclusively in one field, could be adapted to another. Such material then began showing up in courses required for the bachelor's degree in more than the originating field. This cross-pollination has now reached a level that makes knowing the undergraduate degree inadequate for knowledge of the courses that will be found on a graduate's transcript. Yet many industry and government recruiters continue to ask for interviews on the basis of degree designation, assuming they know what they are getting, and deny themselves access to degree holders in other fields, assuming they know what they are passing up. This paper shows that degree designation is insufficient to define the bachelor's level engineering education. As a result, US industry and government, and the graduates involved, are poorly served by recruiting practices which use undergraduate degrees as a discriminator. Changing the system only requires recruiters to ask college placement offices to provide candidates with certain technical specialties rather than by degree designation.

INTRODUCTION

THE SUBJECTS of this paper are two-fold; the true nature of engineering education at the nation's leading universities so involved, on the one hand, and the way that engineering education is perceived by the human resources offices which hire graduates for our nation's industry and government, on the other hand. For the purposes of this discussion, HRO perceptions are deduced from their actions when dealing with college placement offices.

I begin with anecdotal information that I believe almost everyone on an aerospace engineering faculty, at least, has heard many times from students soon to graduate: namely, 'Company XYZ was recruiting on campus. I asked to be considered for an interview, but was told they were only interviewing candidates for the $\alpha\beta\gamma$ degree, not Aerospace.' Now, not everyone who recruits on college campuses makes that mistake. There *are* individuals, unfortunately rare, in my experience, who will go directly to the faculty members with whom they have previously made contact, and say things like, 'Can you recommend students with particular interests and some preparation in automatic control applications?' Or, 'What faculty member—in any department—can lead me to students who have taken some finite element method structural analysis?' It is not *those* thoughtful individuals to whom this paper is addressed; rather to the engineering managers who say to their Human Resources Offices, in essence, 'We have openings for *n* Electrical Engineers,' or '*m* Mechanical Engineers,' when they really mean that they have need for new graduates, say, with a fundamental understanding of digital feed-back control systems or—perhaps—drive train dynamics.

To give such anecdotal evidence somewhat more validity, three kinds of survey information are presented here, none exhaustive. First, a listing of positions to be filled, presented by a variety of hiring organizations to Georgia Tech's Placement Office, together with the way candidates' qualifications were requested, at various times during the last year. Second, the results of a survey of recruiters conducted by Georgia Tech's College of Engineering, showing which degree candidates they interviewed exclusively and which were interviewed as part of pairs or groups of various degree designations. And third, a survey of US industry and government employers, by a number of enterprise categories, showing numbers of various engineering degree holders employed in their organizations.

As regards the *true* nature of engineering education, I must admit at the outset that a scholarly study of the history of engineering education in the United States is beyond the scope of this paper. I certainly do not pretend to be expert or even very knowledgeable on the subject. My personal educational experiences as a student in the late forties and early fifties at well thought of universities offering engineering degrees, however, might well be considered more than 'only one data point.' I do think of them as fairly typical, and suspect that others of my vintage found similar situations.

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These experiences include the fact that subjects such as multi-degree of freedom mechanical vibrations and automatic feedback control system design had to be taken in graduate school to be covered with any degree of generality; the first of these usually in a Department of Mechanical Engineering and the second almost always in a Department of Electrical Engineering.

Not only are these subjects now rather routinely found in virtually all good undergraduate programs of engineering, but among engineering educators there is a general expectation that generalized forms of these and a number of other courses, which might be thought of as a kind of second level core curriculum for engineers, will routinely be included in more than one degree program. The content of these courses might not be the same from degree program to degree program; for example, applications of the same theory might vary. The names of the courses are often different. In some cases, each one of a pair of courses might be devoted to each of two topics; in another, two topics might be 'integrated' or 'unified' over two courses. But an unspoken consensus from campus to campus and from department to department—I believe most engineering educators will agree—does exist that elements of this 'engineering core curriculum' are common among several degree programs.

REVIEW OF PLACEMENT PRACTICES

To examine whether my impressions are at all substantiated by facts, I reviewed undergraduate degree requirements in six degree programs—Aerospace, Chemical, Civil, Electrical, Materials and Mechanical—at seven universities—Georgia Tech, Michigan, MIT, Penn State, Purdue, Renssaelaer, and Texas at Austin. My method was simply to take the appropriate information from current catalogues as published by each of the universities. So that any interested reader can check my results, the following guidelines, used in tallying courses required for the various degrees, are noted:

- electives were not counted (recruiters can't tell what electives were chosen by looking at the name of the degree)
- basic mathematics and science courses were assumed to be common and, therefore, not counted
- basic statics and (particle and/or rigid body) dynamics were assumed common and therefore not counted (although ChE and EE curricula generally do not require either of them)
- combined courses, e.g. 'fluid-thermal processes' were counted as $\frac{1}{2}$ (fluids) and $\frac{1}{2}$ (thermodynamics).

Although hardly complete, the results of a limited survey of placement practices are presented here, as indicative of what is prevalent in the relations between soon-to-be graduates and those from industry and government who interact with them and, later, the results of those interactions.

Table 1 shows excerpts from a listing made available by the Georgia Tech Placement Office to students who were interested in being interviewed for jobs in the '95–'96 academic year. It does not show all the company listings that appear in the Placement Office's material, but it covers a sufficient variety of non-aerospace organizations to show—by and large—what students interested

Table 1. Information made available to students as to the interests of potential employers by the University Placement Office (academic year '95–'96)

Company	Position	Desired qualifications (UG degrees)	Transcript required
Dow Corning	Process Engineer	ChE, ME	No
	Design Engineer	ChE, ME	No
Energy Options Inc.	Engineers (Nucl. P.P.&Hdqs)	EE, ME	Yes
Eastman Kodak	Electronics Prods. Div.	EE, ME	No
Flexible Prods. Co.	Process Engineer	ChE, ME	Yes
Florida Power Corp.	Assoc. Systems Integrator	Cmp. Sc., IE, Mgmt	No
General Motors Corp.	Mfg. & Product Engineering	ME, IE, EE	Yes
Hewlett Packard Co.	Hardware Design Engineer	ME, EE	No
Hughes Elect'cs Co.	Member, Tech'l Staff	EE, ME, Cmp.Sc., Appl Phys, Phys	No
Kimberly Clark	Design & Proj. Mgmt.	ME	Yes
Milliken & Co.	Mfg. Mgmt, Prod. Imp't., Eng'g Svcs.	ChE, ME, IE, EE, Env'l E.	No
Motorola (Auto & Ind'l Elect'c Grp.)	Prod. Super's., Mfgs Eng'rs., Proc. Eng'rs.	EE, ME ChE	Yes
Rockwell Int'l (Automotive)	Tech'l Staff	EE, ME	No
Sames Corp.	Design, Mfg. Eng'rs.	EE, ME	No
Schlumberger	Mech'l & Elec'l. Design Eng'rs.	EE, ME	Yes
Shaw Indust's.	Mfg. Mgmt.	ME, EE, IE	No

Table 2. Number of companies that agreed to interview only the degree majors shown

ME	8
EE	6
IE	5
ChE	2
CE	1
AE	0
CmpE	0
MatE	0

Table 4. Distribution and number of positions involved in the survey of recruiters

No.	%	Type of position	Avg. No. of openings
45	64.3	Engineering	15.0
11	15.7	Co-op/Internships	3.3
6	8.6	Technical Sales	12.0
4	5.7	Entry Level Mgmt.	31.3
2	2.9	Consulting	2.0
2	2.9	Information Sys.	100.0

in or concerned with employment find as they begin to survey their marketplace.

I think it is reasonable to conclude from a perusal of this list that the ME degree is seen as versatile enough to be acceptable to a wide variety of enterprises—which, not quite incidentally, express no interest in AE graduates. These facts are not lost on undergraduate students, their families and concerned friends. They see these listings as a convincing snapshot of the job market at any particular time, and by a large segment as an accurate portrayal.

Note, too, that 62.5% of the companies in this table responded to our Placement Office's question by saying that they didn't need to see even an unofficial transcript. In fact, our Placement Office people tell me, although perhaps with just a little hyperbole, that 'no recruiters' ask to see transcripts. I conclude then, that, such recruiters know nothing about electives taken as part of a degree program, nor of the required 'branched' paths providing a mandatory choice by students in some degree programs; for example, at Georgia Tech in mechanical engineering, students must choose between a second course in thermodynamics or a dynamics course dealing with the motion of rigid bodies and introductory vibrations; and between structural vibrations and an alternative course dealing with fluid flow and heat transfer.

Tables 2 and 3 show results from a survey conducted by the Dean's Office of Georgia Tech's College of Engineering of 200 recruiters, of whom 40 (i.e. 20%) responded by the time the data were compiled [1].

Table 4 lists the distribution of the kinds of positions these recruiters attempted to fill, and the number of such positions they said were open. Note that only about 9.2% of the total were engineering positions.

Table 5 shows how many different degree designations could interview for the various job categories. Note that recruiters for only eight different job categories (or 14%) allowed four or more different kinds of degree holders to be interviewed, whereas recruiters for 49 different job categories (or 86%) restricted interviews to three or fewer degree designators. In fact, the largest number of job categories associated with a specific number of degree designators, 22, restricted interviews to just one academic major. It seems reasonable to conclude that recruiters had high confidence in their knowledge of what they would be getting when they recruited by degree designator.

Table 2 would seem to indicate that a fairly large percentage of recruiters believe that only ME's, EE's, and IE's can perform satisfactorily in the positions they were recruiting for—or, at least, believe that the likelihood of holders of other degrees doing so is too low to make an interview worth their while. Recruiters for enterprises needing AE's, CmpE's or MatE's, by contrast, all believe they have sufficient need for holders of at least one other degree designator, that they were willing to broaden their interviewing to other majors, in addition to AE's, CmpE', or MatE's.

Table 3 contains a corollary kind of data; namely, that ME's, EE's and IE's are seen as sufficiently useful to a large percentage of enterprises that they will be interviewed with one or more other academic majors 3.2, 2.6 and 1.9 times as often, respectively, as for example, AE's. Again, one seems forced to the conclusion that these recruiters—and there seems no reason to expect them to be untypical—believe that academic

Table 3. Number of times the following degree majors were interviewed with one or more of the others

ME	68
EE	54
IE	39
ChE	28
CE	12
AE	21
CmpE	20
MatE	12

Table 5. Correlation between number of degree designators and job categories for which they would be interviewed

No. of Job categories	%	Different majors
1	1.5	10
2	3.0	5
5	7.5	4
16	23.9	3
11	31.3	2
22*	32.8	1

* Includes 9 co-op positions. All were single majors.

Table 6A. Manufacturing, including agriculture, mining, and oil and gas extraction

Occupational groups	Aircraft & parts	Chemicals drugs, & plastics	Computers & office equipment	Electrical & electronic equipment & precision instruments	Fabricated metal products	General machinery (except computing equipment)	Metals production (ferrous nonferrous, others)	Motor vehicles & parts	Petroleum & gas extraction & products	Space vehicles missiles & ships
Aerospace	28,831	14	34	1,655	221	296	32	43	0	2,759
Chemical	485	18,628	279	4,107	309	789	827	125	4,913	498
Civil	1,408	1,384	90	721	1,348	446	542	105	1,360	532
Computer	18,601	12,951	39,306	53,336	3,918	10,012	3,802	4,089	5,123	4,914
Electrical/electronic	10,088	3,406	19,046	102,336	1,492	9,857	1,787	1,249	1,339	6,629
Industrial	11,832	4,065	4,722	26,604	3,800	8,250	2,440	7,107	997	2,478
Mechanical	11,437	7,665	4,179	30,627	10,524	31,901	3,179	7,848	2,847	5,266
Metallurgical/materials	1,216	322	130	1,278	1,033	1,187	3,560	285	144	360

Table 6B. Non-manufacturing: construction, utilities, trade, finance and services

Occupational groups	Other durable goods	Other nondurable goods	Business services	Communications utilities	Construction	Electric & gas utilities	Engineering services	Finance, insurance, & real estate	Research & testing services	Wholesale & retail trade	Other services & utilities
Aerospace	14	118	3,355	290	149	37	6,208	2	7,010	265	989
Chemical	484	3,933	1,929	62	689	773	5,349	25	2,950	445	791
Civil	646	552	4,808	1,154	10,805	3,323	59,032	812	2,304	477	3,322
Computer	4,244	20,008	166,227	9,245	1,080	9,603	13,116	78,302	13,988	26,718	57,520
Electrical/electronic	1,236	3,148	25,085	16,472	5,846	16,574	26,455	1,124	23,897	35,864	7,088
Industrial	4,527	10,440	3,925	1,185	1,158	2,071	4,853	676	2,009	2,281	3,667
Mechanical	4,693	14,388	10,479	700	2,498	3,638	29,905	1,251	7,866	7,076	6,573
Metallurgical/mat'ls	1,491	124	1,146	88	80	537	703	46	2,125	78	746

Table 6C. Government

Occupational groups	Federal (including postal service)	State & local (except hospitals education)
Aerospace	8,840	343
Chemical	1,444	239
Civil	13,791	60,293
Computer	54,484	27,945
Electrical/electronic	32,485	6,662
Industrial	2,948	2,657
Mechanical	12,428	1,128
Metallurgical/mat'ls	1,579	116

majors with an ME degree must have quite different capabilities than those holding an AE degree.

Tables 6A through C, although compiled from information regarding employees in the US in 1993 [2] and, hence, reflecting the influence of hiring practices in the years before that, can—I believe—be viewed with the expectation that such things (hiring practices and the resulting employment) do not change very rapidly.

It is not surprising, then, to see similar patterns in employment as regards matching degree designation and the nature of the enterprise. That is, ME's, for example, are employed in large numbers in a wide variety of industries and levels of government, whereas substantial AE employment is restricted to a relatively few enterprises. What is begun in the recruiting process continues, apparently, in ultimate employment. Only in the 'Aircraft and Parts' column (Table 6A) do Aerospace Engineering degree holders comprise the leading occupational group (34.4% of those shown) and, even there, ME's make up 15.6% of that engineering work force. On the other hand, in the 'General Machinery' industrial grouping, where ME's account for 50.8% of those engineers employed, AE's contribute less than 0.5%. And in 'Motor Vehicles and Parts,' ME's make up 37.6% of that grouping's engineers, while AE's are less than 0.2%!

Such trends continue in less likely groupings, for example in the 'Electrical and Electronic Equipment and Precision Instruments' column, where ME's contribute 13.9% of the work force, and AE's account for 0.75%. And in the (somewhat odd) grouping of 'Space Vehicles, Missiles and Ships,' ME's account for almost twice the percentage of work force represented by AE's, 22.5% compared to 11.8%. Similar comparisons appear in the 'Engineering Services' category (Table 6B) 20.5% for ME's vs. 4.3% for AE's. Only in the Research and Testing Services (Table 6B) and 'Federal' categories (Table 6C) do AE's provide roughly equal percentages of the work force as ME's—11% vs. 12% of the former and 6.9% vs. 9.7% of the latter, respectively.

Such data as this doesn't reveal it, of course, but it would make for a very interesting comparison to know how well the average of those employees making up the very small percentages of the AE's in the work force of non-aerospace industries perform relative to the average engineering employee in that industry.

RESULTS OF A REVIEW OF ENGINEERING CURRICULA

Some minimal disclaimer seems appropriate in discussing the information summarized in Tables 7A through H. As noted earlier, it was compiled by reviewing descriptions of curricula and the courses which comprise those curricula in the undergraduate catalogues routinely provided by universities to those interested in their instructional programs. Such descriptions are necessarily brief. It follows that an 'outsider' is likely to misunderstand the real content of some of the courses listed. Where I have gone wrong I am hopeful that I will hear about it from an appropriate and understanding person on the particular campus which I may have—inadvertently and without malicious intent—wronged. By and large, however, the cryptic categorization in Tables 7A through H are, I believe, a reasonable representation of what is required for each degree shown.

The large and perhaps surprising number of blank spaces in these tables occur mostly because the respective faculties have provided their degree candidates with electives, very often in the form of branched requirements allowing the student to concentrate in one sub-specialty at the expense of an other; e.g., fluid mechanics vs. solid mechanics. Blanks in these tables, therefore, don't imply inadequacy of the associated degree programs, only that you can't tell what preparation the BS degree holder in that program has had, without looking at his/her transcript. Finally, entry positions in the table which are X'd, indicate that there is no undergraduate degree program in that major at that university.

It is noted that the fairly high degree of uniformity within given degree programs across school lines reflects—among other things—the enforcement mechanism of accreditation [3]. Substantial changes to the accreditation criteria are now being debated and formulated, but what is in Tables 7A through H reflects the existence and acceptance of the criteria outlined in Reference 3 for a substantial period of time. These criteria insure, furthermore, design experiences in every major shown in the tables in this paper, with such qualifiers as:

- conceptual or preliminary design which integrates a pertinent technical areas through . . . trade-off studies (AE);
- capstone engineering design (ChE, Mats E);
- comprehensive (ChE, CE);
- predicated on the accumulated background of the curricular components (EE);
- integrated educational experience . . . in . . . engineering design. (ME).

In other words, all these undergraduate curricula require an integrating, comprehensive design course.

Now as to comparing what virtually all these universities require in specific degree programs, please note the following:

- AE's are required to take more of the specific engineering science kinds of courses listed than any other of the majors shown. This seems in keeping with the nature of aerospace engineering as a systems integrating activity, in which a

Table 7A. Universities which require courses in circuit theory for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	1*	2	1	½*	1	1	½
CE	1*	—	—	—	—	1	—
ChE	1*	—	—	—	—	1	—
EE	—	1	1½	3½	2	1½	1
Mat'ls E	1*	—	2	×	1	×	—
ME	1	1	1	1*	1	1	1*

* Electronic Measuring Systems

Table 7B. Number of courses in control theory required for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	1	1	1	½	1	1	2
CE	—	—	—	—	—	—	1½
ChE	1	1	1	1	1	1	2½
EE	—	—	½	½	1½	3½	2
Mat'ls E	—	—	—	×	—	×	1½
ME	—	1	1	—	1	2	2½

Table 7C. Universities which require courses in structural analysis for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	4	1	1½	2	1	2	1
CE	1	2	2	1	1	—	2
ChE	—	—	—	—	—	—	
EE	—	—	—	—	—	—	
Mat'ls E	—	—	—	×	—	×	
ME	—	1	—	—	—	—	

Table 7D. Universities which require courses in structural dynamics for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	1	1	½	½	—	1	½
CE	—	—	—	—	—	—	½*
ChE	—	—	—	—	—	—	½*
EE	—	—	—	—	—	—	—
Mat'ls E	—	—	½	×	—	×	—
ME	—	1	—	—	—	—	½*

* 'Dynamics of Systems'

Table 7E. Universities which require courses in fluid dynamics for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	5	2	3	3	2	2½	2½
CE	2	1	2	1	1	1	1
ChE	1	1½	1	½	2	—	1
EE	—	—	—	—	—	—	—
Mat'ls E	—	½	½	×	—	×	—
ME	2	1	1½	1	1	1½	1

Table 7F. Universities which require courses in strength of materials for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	2	1	2	3	—	1	1
CE	1	2	1½	2	2	2	2 OR 4**
ChE	1	—	—	—	—	—	—
EE	—	—	1	—	—	—	—
Mat'ls E	3	1	4½	×	9	×	1
ME	2	1	3	2	2	5½	2

** Structural Engineering Option

Table 7G. Universities which require courses in thermodynamics for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	1	1	1	1	1	1½	1½
CE	—	—	1	—	1	1	1
ChE	2	2	3	1½	1	1	3
EE	—	—	—	—	—	—	1
Mat'ls E	2	1½	½	×	1	×	2
ME	3	1	2½	2	2	2	3

Table 7H. Universities which require courses in vibrations for the bachelor degrees shown

	Universities						
Degrees	GIT	MIT	Michigan	Penn State	Purdue	Texas (Austin)	RPI
AE	1	1	1	1	1	1	**
CE	—	—	1	—	—	—	—
ChE	—	—	—	—	—	—	—
EE	—	—	—	—	—	—	—
Mat'ls E	—	—	—	×	—	×	—
ME	—	—	1	1*	—	—	—

* 'Dynamics of Systems'
** See 'Structural Dynamics,' Table D

thorough grounding in the fundamentals of all the contributing sub-disciplines is necessary.

- More advanced work in thermodynamics is required rather uniformly of ME's than is required of AE's.
- Except for more advanced undergraduate education in thermodynamics, AE majors would seem to have everything required of ME degree candidates also required of them, and considerably more, as well.

It seems clear, then, that to seek ME graduates for employment, exclude AE's from interviews and find no need to look at transcripts doesn't make much sense, judging by today's curricula, for the majority of positions. For those relatively few positions requiring more advanced preparation in thermodynamics it may be reasonable, but at least in the rather typical listing of Table 1—there are not many such positions readily identifiable.

CONCLUSIONS

Employment data show that holders of aerospace engineering degrees are grossly underrepresented in non-aerospace industries when compared with the number of mechanical engineering degree holders so employed. Some of this disparity is certainly due to the numbers of graduates in each field. But recruiting practices can be at least contributory causes to both kinds of statistics. By approaching the job interview process saying ME's are of interest and AE's are not, these lop-sided employment figures are bound to result. Undergraduates choose their degree programs, influenced—often in a determinative way—by this distorted 'job market.' Nothing in the currently required AE and ME curricula justifies these prejudicial differentiations. Both the hiring companies and the graduates are done an injustice by such recruiting practices, which largely ignore the curricular content of the degree programs.

To bring placement practices of the latter half of this decade into compatibility with the spectrum of coursework material graduates have been taught is quite simple. Managers seeking to fill open engineering positions and HRO recruiters trying to satisfy their needs should stop specifying degree programs. Instead, they should specify the desired technical specialty and ask to see the transcript entries which prepared the graduate for that specialty. Placement offices of college campuses would arrange interviews accordingly. Such technical specialties might include:

- design of electromechanical devices
- structures analysis and testing
- design of automatic controls
- structural dynamics and vibration analysis
- conceptual/preliminary design of vehicles
- heat transfer system analysis and design
- drive system dynamics analysis and testing
- fluid transport system design

and, of course, others. In following such a procedure, recruiters would all come to understand that aerospace engineers know more than just aerodynamics and orbits, and they would find out what electives other students took, to fill all the blank spaces in Tables 7A through H. When industrial and government recruiters begin expressing their needs in this more meaningful way, and begin looking at transcripts routinely, their organizations will begin to build cadres of young engineers whose educations are better suited to serve them, as these organizations wish and deserve. In the national drive for efficiency and competitiveness in the international marketplace, better prepared engineering staffs can hardly be a negligible requirement.

In discussions with recruiters about placing aerospace degree holders, one often hears about the reluctance of non-aerospace organizations to hire them 'because their true love is aerospace; any other kind of job is second choice, and they'll switch jobs the first time an aerospace opportunity arises.' Refuting such 'conventional wisdom' is the long list of aerospace engineering graduates, that I—and probably any number of my colleagues across the country—can cite, name by name, comprised of people who have risen to positions of high responsibility, often to the top, of non-aerospace enterprises. All of these non-aerospace successes may have started out with the idea that only aircraft or spacecraft interested them, and then found that the challenge, opportunities and satisfactions of other activities led to their lifetime careers, to the very substantial benefit of their organizations.

Responsible engineering organizations in the US are taking increasingly concerned interest in the university process of educating the engineers of tomorrow, as well they should, considering national and their organization's well-being. Not the least of their interest, concern and resulting actions, then, should be with a proper matching of the graduates' education and the challenges of the position he or she is asked to fill.

REFERENCES

1. Data courtesy Associate Dean for Academics, Dr. Jack Lohmann.
2. US Bureau of Labor Statistics Historical Industry Occupation Matrix (see technical notes, pages 6 and 7) for 1993.
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