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TED GALAMBOS: THE LEHIGH YEARS

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Abstract

Ted's career at Lehigh began just after the closing phases of a major immigration to the United States following World War II. It brought to American some outstanding scholars. Ted is one of those. As a matter of fact, it was because of a much earlier war that Ted was even able to come to Lehigh. The university was founded by Asa Packer, one of more than a few industrialists who used the income from their enterprises during the Civil War to establish universities. Without that philanthropy, Lehigh would not have existed. And of course it was John Fritz' pioneer work that firmly established the steel industry in the Lehigh Valley -- providing opportunity for cooperative research with that industry.

Ted took advantage of this opportunity, receiving his PhD degree, after which he provided leadership to graduate students who followed him. This team not only completed (and published) state-of-art research on column behavior, beam stability, and the inelastic behavior of structures, but under his leadership, codes and standards benefited from the results of his team's work.

Ted's Lehigh years were widely recognized, and it was no surprise when a leadership opportunity came from Washington University at St. Louis. He took it, but we knew that we wouldn't lose him.. The great thing about the "Lehigh Mafia" (Ted's term) is that we keep together, either in society meetings, committees, councils, joint research projects -- or just plain fellowship.

Ted's career has been a bright star for Lehigh. We are proud of him.

This is the story of the nine years that Ted Galambos spent at Lehigh. It is the story of a man who capitalized on the opportunities afforded by a series of unique, individual decisions. Asa Packer, builder of the Lehigh Valley Railroad, founded Lehigh University. John Fritz, known as the "Father of the Steel Industry in the United States" and a charter member of Lehigh's Board of Trustees, designed, built, and endowed the Fritz Laboratory. In 1928 Lehigh's President Richards visualized what could be done with Fritz Lab as a graduate research center and brought Willis Slater from the National Bureau of Standards to be the first director. Slater attracted Inge Lyse to join with him in the Lab's early research. Lyse, following later in Slater's position, offered Bruce Johnston a research assistantship at a time of great need: it was at the depth of the Depression. Johnston eventually became the director, and following World War II he decided to return to Lehigh and establish the post-war research program in steel structures. It was a program that was attractive to Ted and he made a decision of his own: to apply to Lehigh.

Two things Johnston did were important factors in Ted's coming to Fritz Lab. First was his leadership in the formation of the Column Research Council, building on a suggestion by Jonathan Jones, chief engineer of Bethlehem Steel Company. The second was Johnston's vision in developing an integrated research program at Lehigh entitled "Welded Continuous Frames and Their Components". Its function was to carry out research in what later came to be called "Plastic Design", the theory for which had been strongly confirmed by the performance of steel structures in the bombing of Britain during World War II.

We pick up the story of Ted's travels and decisions, mostly in his own words.

Leaving Hungary: "Towards the end of the war, in November 1944, my parents decided to leave Hungary because of the fear of the Russians. We ended up in Bavaria, where we were liberated by the American army."

Immigrating to the United States: "I finished middle school in 1948, and we were able to immigrate to the US in December of 1948, courtesy of the UN, President Truman (that is why I am a lifelong Democrat), and my dad's aunt in Akron, Ohio. My Dad was a Baptist preacher who had earlier worked in Hungary for the North American Baptist Conference, a predominantly German group. They had many churches in North Dakota, and that is where my father got his first position, and that is how we ended up in North Dakota." Yes, Ted was a "pastor's kid" -- and in the finest sense of the phrase. He was a devoted family man. Every Sunday while living in Bethlehem he taught Church School -- but didn't wear his religion on his sleeve.

Studies in the US: "I started my studies at the University of North Dakota in Grand Forks in the Fall of 1949. I received the BSCE in June 1953, and the MSCE in June 1954. The reason I stayed on for the MS was because I could not get a good job while I was not a citizen (how times have changed!). I became a citizen in May 1954."

Work in the US: "I started working at the Babcock and Wilcox Company in Barberton, Ohio in June 1954, designing boiler structures."

The Army: "In October 1954 I was drafted into the US Army, where I spent most of my time in airfield construction on the missile range in the Bahamas. I was discharged in April of 1956 because our job was finished and they were 'downsizing' the army."

To Lehigh: "I went back to Babcock and Wilcox right away. I realized that I really needed more education to cope with the challenges of the modern world, so I wrote to Lehigh and to Illinois. I got a long letter from Illinois, with lots of information and lots of conditions. I got a phone call from you. You were much more convincing, so I got to Lehigh on September 1, 1956 at the same time as George Lee, John Fisher, Ramez Khabbas, and Thor Anderson. (I had wanted to come to the plastic design summer conference in 1955, but I could not get leave from the army just then. I had read about it in the ASCE magazine, and I was familiar with the Lehigh research from the ASCE Proceedings.)"

The record from Ted's "P-10 personnel file" shows that things moved just as rapidly as he described them: 6/24/56: Ted's letter of inquiry. 6/29: My reply. 7/8: Ted is interested. 7/13: Application forms received. 7/27 Telegram offer of RA. 7/28 Ted's phone call accepting. 7/31: My confirming letter: "Ketter will be your research supervisor on column studies related to Plastic Design. The stipend will be \$175/month." (The details of each step in this process were summarized on the occasion of the Washington University celebration of Ted's 50th birthday (Beedle, 1979))

What happened to Ted at Fritz Lab?

First, he had to suffer the indignities of the initiation -- which he came through "swimmingly". and he had to take whatever desk assignment came down the pike. Housing was in short supply, so finding a place to sleep wasn't all that easy. He was introduced to Gus's where we went for coffee (that was before the days that there were coffee pots in so many of the Fritz Lab offices) and now Gus's is gone, replaced by a lawn in front of the later Maginnes Hall.

Within a month of his arrival he saw the culmination, for others, of that which brought him to Lehigh -- the awarding of PhD degrees to three of Lehigh's "greats": Alf Huber, Gerry Haaijer, and Bob Ketter (as noted, Bob was his research supervisor). Alf, originally from Austria, went to Argentina where he first worked for Acindar Steel Company, then as professor at the Rosario National University. Gerry Haaijer went to US Steel (eventually directing its research laboratories) and then to Chicago as Vice-President for Engineering at the American Institute of Steel Construction. Bob Ketter left for Buffalo, eventually serving as President of SUNY.

Perhaps most important in "what happened to Ted" is the colleagues -- the others that were here when he arrived -- or who came and went during his nine years at Fritz Lab. It's an impressive list. More than 200 students, researchers, and faculty are listed in Appendix 1. We were just coming off the "high" of the 1955 Summer Conference that bought him, and many others, to Fritz Lab.

But of course "What happened..." is not the right question. The significant one is....

What did Ted do with his time here?

How did he capitalize on the opportunity? What use did he make of the interactions that those 200 people could make possible? What did he do with the opportunities for study? for teaching? for leading other researchers? for disseminating the new information through publications, lecturing, and consulting? for recuperating through an occasional leave of absence?

His P10 file (one of the most complete in our offices) shows how well he took advantage of those opportunities. His quarterly reports are illuminating -- marvels of conciseness, clarity, and reflecting how a person with motivation can capitalize on those opportunities. Several of these quarterly reports were included almost verbatim in the 50th birthday celebration (Beedle, 1979). Such reports aren't required now. But in those early days they were essential because the sponsors at that time (AISC, WRC, and others) required quarterly reports. Detailed annual reports also were required then by the department and the dean of engineering, a practice that was discontinued a number of years ago. Typical of Ted is the entry under "Future Plans" in one of his annual reports: "Keep working as best and as hard as I can."

Let's follow some of the threads.

Student days: In September, 1956 he started graduate study. His PhD committee was formed six months later, his course program was approved in a year, he passed his qualifying exam April, 1958, passed his general exam six months later, and received his PhD in June of 1959. Very good. Two years and 9 months. Not a record, but much better than most. (The record is probably held by one of his PhD students, Morris Ojalvo: Two years.)

Research Projects -- and his students

Ted's first project was on columns (205A). This was the basis for his appointment, received his prime attention, and was the topic he pursued from first to last, right up through the PhD. His thesis was entitled, "Inelastic Lateral-Torsional Buckling of WF Beam Columns".

Not unlike other strong graduate students, Ted worked on other projects during the time of his studies. In fact, his first work after reviewing the literature that Ketter suggested was to help Lambert Tall test coupons for the project on the compressive strength of steel (220A). Even while he was a degree candidate he became supervisor of the local buckling project (205E), and later of lateral buckling studies (205H), guiding the work of George Lee, eventually becoming George's thesis advisor. Morris Ojalvo cut his eye teeth on Fritz Lab research working with Ted, who also later advised Morris on his own PhD work on restrained columns (278)

Ted was in obvious demand by other universities and for a few months after receiving his PhD he considered several opportunities elsewhere. But the record shows (5Oct59): "I'll stay at Fritz Lab"

From that point on, he moved ahead rapidly, Ted provided an unusual example. He got right out on the floor with his graduate students, working with them in their testing. And the team atmosphere was so strong that, when more hands were required to conduct the large experiments on projects that were not his own, he would often be seen there with a helping hand. He directed, or was co-investigator of 14 separate research projects, a number of which he initiated himself.

These are some of the students who followed him and who benefited from his leadership (more or less "in order of appearance"): George Lee, Morris Ojalvo, Bill Waddington, Frank Vickress,

B.Papadopoulos, Victor Levi, Bob Warner, Karl Van Kuren, Yukio Ueda, Max Lay, Tony Ferrara, Yuhshi Fukumoto, Jay Prasad, R. Aglietti, Harold Reemsnyder, N. Feenan, Charles Culver, Peter Cooper, Pete Adams, John Mueller, Nagaraj Rao, Toto Estuar, C. K. Yu, M.A. D'Apice.

All in all, it is a remarkable collection of engineers who not only made their mark at Lehigh but went on to be leaders, some in other universities, some in firms, and some in government agencies. And they carried on the tradition as well of leading in the process of getting the latest knowledge from research applied in practice.

Teaching

It seems that Ted has always had teaching in his bones. He taught at the University of North Dakota as a Teaching Assistant before he came to Lehigh (materials test lab and soils lab). When he was on a leave of absence during the first summer after coming to Lehigh he participated in a series of lectures on plastic design, using the "Summer Course lecture notes" (Beedle, Thurlimann, and Ketter 1955) -- that had attracted him to Fritz Lab in the first place.

Of course Prof. Eney, the CE department head and head of Fritz laboratory, could recognize a good man, and almost a year before Ted received his PhD Prof. Eney was exploring with course leaders -- especially Ferd Beer in Mechanics -- what the teaching opportunities might be.

With his PhD work out of the way, Ted started off with Mech. 1, then CE 458, then in the following year Mech. 415 and CE 453. In all, Ted taught eleven different courses during his time at Lehigh, this in addition to the many students he advised in PhD committees and in individual study programs. Students always came first. When he might arrive at a meeting just under the wire, he'd say, "Beedle, I had a class!"

Service to the Lab. Although he wasn't one to search for administrative positions, he willingly and effectively carried his share of the leadership opportunities and of course did well in all of them. As a PhD candidate he chaired the Fritz Lab seminar series. He was Fritz Lab coordinator of computers in the days of their infancy. He was co-director of the Structural Metals Division. He was course leader in two special courses that served as preliminary to major publication efforts. In the first he coordinated a course that taught steel design based on the significantly revised 1961 specification of the AISC, 17 members of the faculty and research staff joining together in what eventually became the Ronald Press *Structural Steel Design*. (CE Staff, 1962). The second was what he terms "a dry run" -- a good way to prepare the lecturers and to develop lecture notes and design guides for an up-coming 1965 Summer Conference on Plastic Design of Multi-Story Frames (Galambos et al, 1965; AISI, 1968). He served on the CE honors committee.

Spreading the word:

Reflecting his interest in making sure that the designer had "the latest" available at his fingertips, within two months from his arrival at Fritz Lab he was presenting reports to a research project committee and the following year a formal oral presentation at the annual meeting of ASCE. That was followed, of course, with the written manuscript, following that important tradition started by Slater and pursued by Lyse and Johnston, that papers had to appear in the important journals -- and quickly. In fact, Johnston initiated the tradition of "Progress Reports", formal publications that got the word out on completed phases of larger, long-term projects.

In this regard, Ted's life from that point on was intimately involved in getting information out to the research committees, then to publication. He has been one of Lehigh's "shining lights" in that regard. At first he would represent us. By the time he left Lehigh he was member in his own right of eight technical committees (ASCE, AISI, and CRC)

In a surprisingly short time he was making trips overseas, the first of these to a 1962 conference in Krynica, Poland. His memorandum about arrangements for his work during his absence (that were marvels of completeness) includes such comments as, "I will be the only delegate at the conference from outside the Communist Bloc"....."I will do all within my power to avoid becoming an Incident in the Cold War."....."If I am not back by Oct 1, and no reason has been

given by me for the delay, please initiate inquiry by State Dept." His postcard from Poland said, "These are such wonderful people."

Ted also participated actively in one of our most important technology transfer efforts (the first two being the 1955 Summer Course and then the AISC Engineering Conference held at Lehigh in April, 1956, the first and only AISC conference to be held at a university.) During the last year of his PhD work, he used his research findings to contribute to what would eventually become WRC-ASCE Manual No. 41, *Plastic Design of Steel Frames* (1961)

His research on columns put him in active touch with what was then the CRC (now SSRC), and his first work for the Council was to translate the stability provisions of the German specifications published jointly with Jonathan Jones. Ted went on to present his research findings to the technical committees of CRC and shortly after receiving his degree was appointed as a member of its Committee 2, a group providing advice to research directed by George Winter at Cornell University. In addition, he was called upon to represent the Lab at meetings of Committee 15 of AREA, reporting on his stability research. Eventually, this led to his election in later years to the position of Chairman of the CRC and beyond that to the position as Editor of the world-famous *SSRC Guide to Design Criteria for Metal Compression Members*. (Galambos, 1988)

Textbooks are probably one of the most significant forms of technology transfer and one of the largest efforts to come from the Fritz Lab group was *Structural Steel Design*. This all started when Ted was at Lehigh and as noted above, he had a strong hand in it.

Ted knew the value of books. Starting in 1963 he took off for two summers to do the basic work on his valuable text, *Structural Members and Frames* (1968), resulting from the course CE 453 which he taught.

During the last of "The Lehigh Years" we joined together to produce a chapter on plastic design for the Gaylord and Gaylord *Handbook* (1990), now moving into its fourth edition.

What was the impact of his Lehigh years?

Ted was part of that fine group of leaders who gave of themselves in the classroom and the laboratory sending throughout the world those who would become leaders in the field of structural engineering.

The results of his research found their way into practice and he was quickly made a member of the technical and specification committees that were in a position to accomplish that implementation.

He was called upon frequently as a consultant.

During his time at Lehigh he started receiving major honors (first was the Huber Research Prize), a process that continued unabated in his later career. Among other honors, he received the ASCE Moisseff award and State-of-the-Art award, the T. R. Higgins lectureship award of the AISC, and he was elected to the National Academy of Engineering.

Then what happened?

We had an early warning in October, 1964: He told us that he had been invited to give a seminar at Washington University, St. Louis. In November the seminar became a fact, and in May of 1965, his departure became a fact as well: "I have been appointed professor of Civil Engineering at Washington University St Louis and will assume my duties Sept 15, 1965.....I will be in charge of research and both undergraduate and graduate instruction in the structures area.....I have spent the happiest years of my life here.....I have the highest regard for my colleagues here....Fritz Laboratory has long been the foremost training ground for leaders in the field of structural engineering.....I will always appreciate the opportunities I had....The Fifties and Sixties at Fritz Lab were a great time for structural engineering, and I am thankful and proud to have been a part of it."

Pete Adams (one of his graduate students) organized a "Final Orgy" for Ted at Beethoven Waldheim Park. Dave Van Horn wrote the poem.

His memorandum, "Transfer of Duties Upon Leaving" is probably the most complete we ever received. And his final annual report, prepared just before that, had two perceptive recommendations: "Diversify sponsors. Don't be dependent on one." and, "Expand into earthquake engineering and bridges." Both of these happened.

In summary, he made the best of what Fritz Lab, the CE Department, and Lehigh affords. He took the ball and ran with it. He joined the host of those who preceded him, and who followed, in adding to our reputation as a premier place to work. And yes, even to play.

A Final Word

The time I've spent writing about Ted's Lehigh years doesn't seem to have all that long. It's been quite a nostalgia trip, starting back in those times when a secretary would get as many carbon copies as possible from a single typing (remember onion-skin paper?), when we prepared technical reports using mimeograph, and wrote internal memos on Ditto. It was a time when we needed sufficient secretarial help to type and re-type. How things have changed! Now most of our reports are created right at the keyboard and are sometimes produced with no typing support whatever.

But most important as I've reviewed the years of the 50's and 60's has been the recollections of the people I worked with and seeing the impact that Ted made upon all of us. Ted's career has been a bright star for Lehigh. We are proud of him.

Appendix 1

The Colleagues of TV Galambos (1956-1965)

Adams (J) Adams (R) Adams (P) Aglietti Ali Allan Anderson Apmann Arnold Assimocopoulos

Badaliane Badaux Bagge Baldino Baldwin Basco Basler Beedle Beer Bendigo Bewley Blackmon Borg Bott Brach
Brecht Brey Brune

Carpenter Caspe Cassan Castro Chapman Chen Chevin Christopher Connor Constante Cook Cooper Corrado
Cowen Cranston Culver Cutler

D'Huy Daniels Danieri D'Apice Darlington Davidson Dawson Debly Deininger de Jesus Deutch Dinsmore Dittig
Dlugosz Donovan Douglas Driscoll Dudley Dwyer

Eddy Ekberg Erfle Errera Estuar

Feder Feenan Ferrara Ferritto Fisher Florance Foreman Foust Fujita Fukumoto

Gaedeke Gerridge Gilkey Gimsing Giraldi Gokkent Gozum Graham Grigoriadis Grum-Schwensen Guilford

Haaijer Halasz Heins Haines Halasz Hansell Hansen Hanson Haque Harrison Heimberger Herbert Herbich Higgins
Hla Holmes Huber Hulsbos

Isaacs

Jauntirans Jenkins Jensen Jones

Kable Kamalvand Kar Kawai Kerfoot Ketter Khabbaz Kilmer King Ko Kocaoglu Konchar Kondo Kormanik Krasas
Krehnbrink Kulak Kulicki Kurbar Kusuda

Lane Laub Lay Lee (G) Lee (T) Leonard Levi Lew Liebig Lindner Locsin Lohrmann Lu

Macias Madison Magee Mariani Maurer McCullough McFalls McLarnon McNabb McNamee McPherson Miller (D)
Miller (R) Mindlin Montemayor Mueller Mullen Murphy

Nasr Nasser Nester Neville Nielsen Niimoto Nishino Nitta Nuwaysir

Odar Ogawa Ojalvo Okuto Ople Osborn Ostapenko

Pai Papadopoulos Parick Paris Parker Patel Pielert Pitts Prasad

Quinones

Rampetsreiter Ramseier Rao Recchio Reemsnyder Reimer Roesli Rosner Rumpf

Santos Sarrubi Sastri Schaffer Schiffman Schneck Schutz Seaman Sherbourne Shieh Shindala Slutter Smith (J)
Smith (P) Snyder Sorensen Steirer Sterling Stout Strausser Strawbridge Swindlehurst Sword

Talian Tall Tamaro Tanner Taylor Taysi Thurlimann Tide Toh Torres Tsiuji

Ueda

Vallentine Van Horn Van Kuren Van Weele Varney Vesilind Vickress Villanueva Vojte

Waddington Wagner Wakabayashi Waldron Wallaert Wlther Warner Warnock Weiss White Wilson

Yarmici Yen (B) Yen (Y) Yerlici Yordy Yu Yura

Zanoni Zarzeczny

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