

# Fifty Years in Engineering Distance Education: Past Trends and Future Directions

## Abstract

In this paper, the history of the distance education work in the College of Engineering at Iowa State University is described and analyzed. The university's and college's early commitment to deliver high quality distance education is explained as is the development of new approaches to delivering distance education over the 50-year history of the program. Data from key leaders in the program combined with records and documents suggest three major themes: 1) the importance of creating key collaborations with industry partners to both serve and create the audience for distance education initiatives; 2) a continuous commitment to high quality programs taught by full time university faculty members with the same quality and rigor as the on-campus programs; and 3) the importance of identifying and sharing key strong program areas from the College of Engineering. Program leaders from the rich 50-year history of distance education in the College of Engineering agree on the importance of strategically building upon the long and successful history of high-quality distance education in the College of Engineering and maintaining Iowa State University's leadership and commitment in this important area.

## Purpose

In the past decade, Colleges of Engineering around the country have created numerous structures designed to support high quality distance education experiences for students. These structures have met with varying degrees of success, with some creating the basis for large, effective distance education programs and others struggling to survive. The College of Engineering at Iowa State University will celebrate 50 years of distance education in 2019. In this 50<sup>th</sup> Anniversary paper, we provide a summary of the major milestones in the development of distance education in the College of Engineering and describe the major themes that surround the development of the structure. We conclude the paper using data from the history of distance education in the College of Engineering to provide recommendations for future directions.

## Methods

In order to define these milestones themes and recommendations, we used historical methodology to determine significant events in the development of the current program. Through the study of past events and personalities, historical methodology helped shed light on current happenings and future trends.

Data sources included people involved in the development of the program and archived records from the program. In order to tell the story of the development of the current Engineering-LAS Online Learning (ELO), the distance education support center in the College of Engineering at Iowa State University, the research team met regularly to engage in collaborative reflection and developed a timeline of important events (Appendix A) that marked the development of distance education in the College of Engineering. We also interviewed key faculty, staff, and graduate students who were involved and/or are still involved with the development of distance education work in the College of Engineering.

The research team that included current ELO staff members reflected and explored jointly the following questions:

- 1) What was the early history of ELO when it was known as Professional Programs in Engineering (PPE) and later as Engineering Distance Education (EDE)?
- 2) What were the important milestones in terms of the development of ELO?
- 3) What are the significant themes in the history of ELO?
- 4) In the context of history, what are the most promising future directions for distance education in the College of Engineering?

In addition to our meetings and document searches, we used an individual interview procedure to collect data on perceptions of key program leaders. We chose to interview Edwin Jones, Ted Okishi, Jim Melsa, Tom Brumm, Ron Cox, Loren Zachary, Sriram Sundararajan, and faculty leader Doug Jacobson.

Questions asked at the interviews included:

- Please describe your role in distance education at ISU's College of Engineering.
- At the time, what was your vision for the future of distance education in Engineering?
- During the time you were a leader, you made some bold moves. What were those? How did you feel about it at that time?

Following each research group meeting and interview, the research team met to define and discuss major themes and events revealed through each session.

## Results

Combining our data from program participants, program leaders, and program documents, we were able to construct a timeline (Appendix A) that summarizes the major developments in the history of distance education initiatives in the College of Engineering.

The first question posed to the research group was: "When did distance education work begin at Iowa State University?" We were somewhat surprised when one participant suggested that the first major initiative began in 1907 with the establishment of the Seed Corn Gospel Train. As the name suggests, the Seed Corn Gospel Train was designed to transport ISU faculty around the state to share current information on successfully raising corn. Although this early effort was not from the College of Engineering, this early commitment to extending educational resources was a precursor to the long term commitment of Iowa State University to its Land Grant charge to: "...follow the principle that all people in the state are, in reality, students of the college. Therefore, we must go to them and help them where they are, under their own conditions, with their own problems" (Pounds, "The Seed Corn Evangelist", 2007).

Over the next several decades, our data describe a consistent record of effective and innovative distance education efforts that emerged. A cadre of talented staff along with inspiring leadership led to new opportunities. Of special note was a collaborative program with Collins Radio<sup>1</sup> in the 1950s that involved faculty travel to Cedar Rapids. Ed Jones remembers these efforts: "These classes had been taught by people that actually rode the trains over to Cedar Rapids. People like Grover Brown and Al Read and some of the others. The trains ran at 120 miles an hour so it didn't take long to get there" (phone interview, May 5, 2017).

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<sup>1</sup> Collins Radio became Rockwell Collins and is now called Collins Aerospace after it merged with UTC Aerospace Systems

Approximately 10 Master of Science degrees in Engineering were earned each year in this program. According to Jones, the average of 10 degrees awarded annually started in the 1950s and continued through the 1960s. In 1969 videotape delivery started and ran concurrently with face-to-face for a couple of years. The 1970s were characterized exclusively by videotape delivery as a way to save money during the recession. Jones often quipped: “We delivered engineering education by “Planes, Trains, Automobiles... and then Videotape”. Course lectures on VHS tapes were delivered through UPS. Engineers at Rockwell Collins would gather on Fridays as a cohort to watch these lectures and work on their advanced degrees. Faculty members visited Cedar Rapids twice a semester in order to establish some personal contact.

Beginning in 1969, the College of Engineering affirmed the importance of its distance education work through the creation of administrative structures that guided and implemented distance education in the college. Our research group work identified four major administrative structures/organizations in the ensuing history of the distance education program in the College of Engineering:

- Professional Programs in Engineering, 1969 – 1995
- Engineering Distance Education (EDE), 1995 - 2011
- Engineering Online Learning (EOL), 2011 - 2012
- Engineering-LAS Online Learning (ELO), 2012 – Present

## Notable Events

Examining the 50-year history of distance education in the College of Engineering, four notable events emerge.

- 1) College of Engineering’s leadership and national reputation was evidenced by the invitation to become a charter member of the National Technological University (NTU), which was founded in 1984 as a partnership between academia, business, and government. Engineering graduate level courses were delivered from NTU participating universities via satellite in both live and taped mode 24 hours, six days per week to 190 industrial locations in the U.S. and Canada. It was considered an honor to have courses selected for NTU offerings. ISU had significant contributions in electrical, computer, and systems engineering; ISU courses were heavily enrolled. The consortium grew to 54 participating universities by 2003 and NTU started a transition to a “for profit” business model. As additional distance education opportunities developed, ISU dropped out of NTU in 2004.
- 2) The development of the Iowa Communications Network (ICN) in 1994 provided the infrastructure for bringing live classrooms to distant locations. ICN is a fiber-optic network that linked some 800 sites with central switching from the National Guard Armory in Camp Dodge, Iowa. The ICN was used to deliver the undergraduate BSEE program to cohorts of engineering students at Rockwell-Collins in Cedar Rapids. The department was able to show that the learning outcomes of these students was substantially equivalent to that of on-campus students, and they were included in the positive accreditation action of the overall program. Thus, the BSEE program was one of the first in the country to be accredited with distance education students.
- 3) The sale of WOI-TV in 1994 produced a funding source for distance education efforts across the University. The College of Engineering funds were used to build delivery infrastructure (studio classrooms), off campus labs and ICN classrooms (Kirkwood) for the BSEE program. The funds also supported early efforts at Internet delivery, expanded partnering with community colleges

for ICN delivery, adaptations of active learning strategies for distance education, development of additional off-campus undergrad programs (B. S. Mechanical Engineering).

- 4) A confluence of internet and web-based technologies in the late 1990's and the leadership of Jim Melsa, Dean of College of Engineering 1995-2004 led to a dramatic increase in the number of distance education courses offered around the state. Melsa was enthusiastic about increasing distance education opportunities and created metrics to measure success. He wanted 50 strategic partnerships and 1,000 active distance learning enrollments. Both were accomplished within 5 years.

## The Development of EDE and ELO

Around 2000, some of the first computer-based approaches emerged in what had become Engineering Distance Education (EDE). EDE introduced the learning management system WebCT to distance education faculty as another method of course delivery along with videotapes. Soon after integrating WebCT, EDE also introduced streaming media to deliver captured lectures over the Internet. Streaming media delivery provided working students the flexibility to view lectures anytime and place.

In addition, demonstrating the commitment to online course design, faculty development, and new distance education pedagogy, EDE hired in 2002, the first College of Education graduate student. From 2000 to 2010, EDE continued to grow student enrollment numbers with an average of 11% annual enrollment increase. It supported more programs and a variety of courses to meet distance students' demand. The number of courses offered through EDE doubled over the period. However, from 2010 – 2018 enrollment growth became relatively static.

In 2010, the College of Engineering appointed Dr. Tom Brumm to lead EDE. Early in his tenure as Professor-in-Charge, Dr. Brumm removed the word “distance” from Engineering Distance Education believing all enrolled students should have access to the online learning environment regardless of location. The new name became EOL (Engineering Online Learning).

In 2012 EOL merged with the College of Liberal Arts and Sciences (LAS) DE unit and became ELO (Engineering-LAS Online Learning). This new administrative structure brought with it increased access to instructional designers and asynchronous models of distance education.

In 2012 the university adopted the Resource Management Model to develop its annual operating budgets and the financial incentives for engineering faculty teaching through ELO disappeared. Both our focus group data and our interview data from leaders suggest that this change in faculty funding for teaching at a distance created a challenge for the development of distance education efforts. Leaders tended to agree that the faculty incentive model was in need for a change and that there needed to be a new, carefully created incentive program for faculty who teach and provide leadership for the distance education program.

## Themes

In addition to providing a chronology of major events in the development of the history of distance education in the College of Engineering, data from records, our focus groups and interviews revealed three major themes that surround this chronology. These themes were defined and refined by our research group as we continued to add additional interviews of program leaders.

- 1) A major theme that emerged from both our focus group work and the interviews with program leaders was the importance of **creating key collaborations with industry partners** to both serve and create the audience for distance education initiatives. During his time as Dean of the College of Engineering, Dr. James Melsa emphasized the importance of university collaborations with business and industry. Dr. Melsa described his vision for these partnerships: "The idea was to build strategic partnerships with particularly the companies in the state of Iowa, and because we wanted to get places that our students could do coop and intern experiences, we wanted to get their knowledge about how the practice of engineering really happened perhaps to our faculty and our students. We wanted to offer to them, as part of this partnership, excellent educational experiences so that their employees could get advanced degrees, could expand their professional repertoire, and of course we hoped at some point they might donate money back to us" (phone interview, June 6, 2017).
- 2) A second major theme involved a **continuous commitment to high quality programs taught by full time university faculty members with the same quality and rigor as the on-campus programs**. From the beginning of distance education work, leaders in the College of Engineering demonstrated strong support for the creation of distance education programs that paralleled the quality of on campus offerings. This use of full-time faculty as distance education instructors also included faculty development and support programs and structures for participating faculty. Sriram Sundararajan, current Associate Dean at the College of Engineering summarized this commitment, "I guess I would think distance learning is when you're engaging people that are not on your campus with a good learning experience that would be equal to if they were on" (interview, December 1, 2017). Dr. Doug Jacobson, University Professor of ECpE has national recognition for his distance learning programs in Information Security. Since 1995, Jacobson has worked to create educational pathways for a varied workforce and developed curriculum using a truly interdisciplinary approach through his Information Assurance Center. He reinforces this theme for equal rigor and quality: "And again, we work very hard and pride ourselves on the fact that ours are still hands on...the students off campus do the same labs, do the same experiments that our on-campus students do" (interview, September 29, 2017). Several interviewees agreed that continuing to offer high quality, innovative distance education programs in the College of Engineering should include reasonable, strategic incentives for faculty who are contributing to the growth and development of distance education in the College of Engineering.
- 3) The third major theme that emerged was the **importance of identifying and sharing key strong program areas from the College of Engineering**. Program leaders emphasized the importance of identifying program niches of excellence and leveraging these programs in distance education efforts. Tom Brumm, ELO's Professor-In-Charge from 2010-2015 stressed "I think you'd be more successful if you said, 'Here's what we're really good at, and we're going to kick butt'" (interview, November 10, 2017). Dr. Jacobson extended this point to suggest a strategy for future growth: "I think there is a handful of programs that we are uniquely positioned to offer to the world. We would first identify what those are. Where our market segment would be. And I think that we build an infrastructure beyond just the infrastructure that exists here. That would accommodate a rapid growth. Then I think you need to go out and market and you need to push these things" (interview, September 29, 2017). The areas identified for excellence in the 2018 College of Engineering Strategic Plan ("advanced materials and manufacturing, energy systems, resilient infrastructures, engineered medicine, engineering education, and secure cyberspace and autonomy") provide suggestions for potential distance education focus.

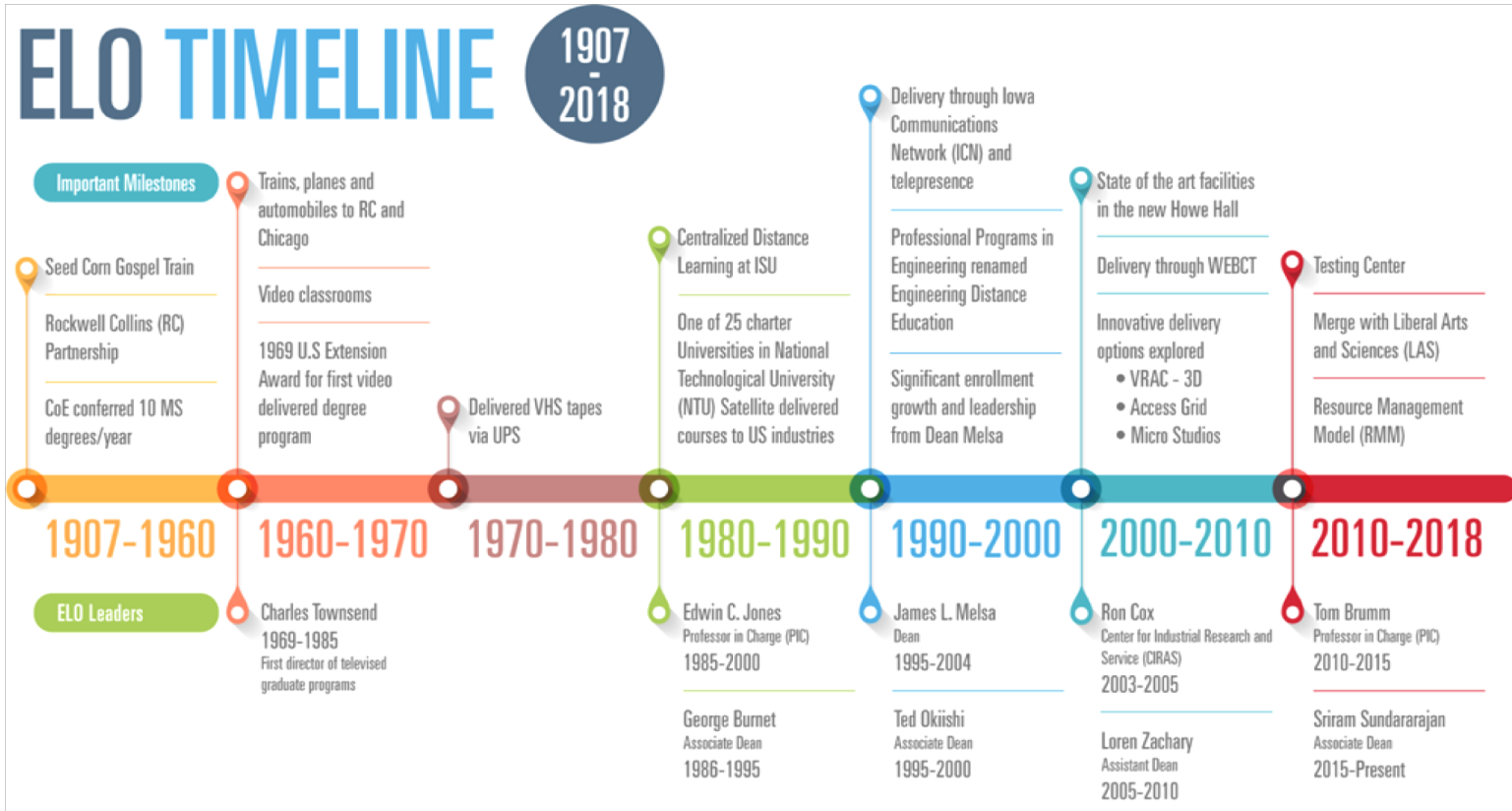
## Conclusions and Recommendations

Beginning with the Seed Corn Gospel Train in 1907, Land Grant Iowa State University has demonstrated a strong commitment to innovative and effective distance education initiatives. For more than 50 years, the College of Engineering has worked to identify areas of need, share high quality programs that address these needs, and ensure quality in distance education offerings. Throughout its history in distance education, the College of Engineering has worked with and supported faculty members to meet the needs of students at a distance. The long history of successful work in distance education provides a strong foundation for future directions. Dr. Ted Okiishi reinforced this point: "There are few things in higher ed where you can kind of look at it and see. We improved. We grew. We're in a position of national leadership now. Why is that? Because a lot of colleges of engineering around the country don't have that sort of a history with this. It tends to be more, 'We'll try this, and then we won't do it for a while, and then we'll try this'" (interview, May 9, 2017).

Taken together, data on the history of distance education in the College of Engineering provide a strong platform for future directions. These data provide clear and focused recommendations for the next steps to continue Iowa State University College of Engineering's history of innovation and excellence in the area of distance education. These recommendations are especially important in the light of the current static rate of growth in distance education in the College of Engineering at ISU.

1. Use areas of excellence within the College and create (or expand) distance education programs from these areas.
2. Work closely with business and industry partners to create and deliver programs meeting the needs of these partners.
3. Provide support for full time faculty members to help them develop effective approaches to teaching at a distance and deliver high quality, rigorous courses.

In conclusion, the data gathered for this paper reveal an interesting and relevant story about a 50 year history of innovative and effective distance education. These data reveal a history characterized by dedicated, innovative leaders and staff, commitment to serving the people of Iowa, commitment to providing rigorous, courses and programs and faculty development and support. Lessons learned from this rich history provide clear direction for the future.





## Appendix B

### ELO Leaders



**Late Charles Lee Townsend, 1930-2017**, provided the vision, direction, and motivation to extend educational opportunities to working engineers back in 1966 and when video tape technology was introduced in 1968/69, he ushered in video based engineering programs. Townsend was on the faculty at ISU for 37 years and retired as an emeritus professor in 1992. His university activities included considerable committee work at the department, college and university level. He received the Award for Creativity, National University Extension Association, 1969. Charles was recognized as an Outstanding Professor in Electrical Engineering, College of Engineering, in 1986.



**Edwin C. Jones, Jr., 1985-2000**, University Professor Emeritus, EDE Professor in Charge, took over the distance education program in 1985 when it was still known as the Professional Programs in Engineering. Jones was also one of the professors teaching courses at Rockwell Collins back in 1966. He expanded the first “studio classrooms” in Engineering Annex created by Charles Townsend. Jones was passionate about creating learning environments that mixed the views of traditional students with those of students working in industry. “Many a times, I have had a student from industry interject our discussion with ‘You know, at work yesterday, I saw one of the engineers do .... Why?’ This usually leads to a discussion of an important issue that occurs in industry but may be rarely discussed in standard lectures” (phone interview, May 5, 2017).



**George Burnet, 1956-1995**, Anson Marston Distinguished Professor Emeritus, College of Engineering, George Burnet served in senior administrative positions in the College of Engineering including associate dean and interim dean in the mid-1990s when NTU and ICN distinguished ISU’s Engineering Distance Education as a premier program in the country. A former president for the American Society of Engineering Education (ASEE), Burnet was a great champion for distance learning and used his considerable influence and authority to position EDE for success.



**Ted Okiishi, 1995-2000**, Associate Dean for Research and Outreach, College of Engineering, helped get the Bachelor of Science in Electrical Engineering (dBSEE) program off the ground. He was an expert in turbine (jet engine) technology. Ted knew how to work with industry. It was not only technology transfer that interested him, he wanted to prepare students to be innovators when they left ISU for that industry job. This led to work with John Deere in the 1980’s. “They wanted a more synchronous delivery like F2F, ICN, videoconferencing. Iowa State delivered live classes to them in the mid 1990s using the ICN to connect to Deere's videoconferencing network” (interview, May 9, 2017)





**James L. Melsa, 1995-2004**, Dean, College of Engineering, returned to academia from a successful career in business to make a difference. He restructured the engineering college empowering faculty and administrators with resources to achieve and stretch goals. He raised money to build the ETRC (Hoover and Howe) and promoted VRAC and Information Assurance as “Best in Class” national programs. Melsa believed partnering with business and industry would help us prepare better future engineers. A key value proposition for industry partners was fostering a lifelong education path through engineering distance education. Melsa was keen on increasing those opportunities and created metrics to measure success. Jim Melsa’s leadership mantra was: *Hire good people, monitor best practices, create lasting partnerships, stay connected*



**Ronald A. Cox, 2003-2005**, Interim Director, EDE, provided leadership to EDE during installment of a new Dean of Engineering and then again as Associate Dean for Economic Development. Ron Cox was and continues to serve as Director for The Center for Industrial Research and Service (CIRAS). A history buff, Dr. Cox reminds colleagues of our rich history in engineering extension starting in 1904 with Anson Marston, Iowa State’s first engineering dean, creating the Engineering Extension Service (EES) which led to correspondence study and the first distance education programs. Ron Cox still works tirelessly to provide “a simple system” for companies to engage with Iowa State.



**Loren W. Zachary, 2005-2010**, Assistant Dean, College of Engineering – EDE Professor-in-Charge, had passion for the mission and the people of EDE. He focused on finding talented people and creating healthy team dynamics. Dr. Zachary also created policy for distance education that provided incentive for faculty, departments, and the college to continue investing effort into distance education. He was keen on understanding our market, potential for impact, and how to fill the need.



**Thomas J. Brumm, 2010-2015**, Associate Professor, College of Engineering – ELO Professor-in-Charge, Dr. Tom Brumm is a leader in assessment and competency-based learning at Iowa State and incorporates service-learning activities into engineering and technology curricula. He has extensive experience teaching online and managing online course delivery programs. During his tenure as Professor-in-Charge, the unit merged distance learning operations with the College of Liberal Arts and Sciences (LAS) and changed its name from EOL (Engineering Online Learning) to ELO (Engineering-LAS Online Learning).



**Sriram Sundararajan**, Associate Dean for Academic Affairs, College of Engineering, ELO Professor-in-Charge, 2015 – Present. Dr. Sundararajan has developed graduate courses on tribology, scanning probe microscopy and broader impacts of engineering. He has also been engaged in efforts to transform the undergraduate mechanical engineering curriculum and introduce engineering concepts to the K-12 community. Dr. Sundararajan is a Fellow of the American Society of Mechanical Engineers (ASME) and serves as an ABET program evaluator. He is an executive committee member of the Mechanical Engineering Division of the American Society of Engineering Education (ASEE).

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