

# University of Washington Department of Electrical and Computer Engineering Ten-Year Review – December, 2023

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## **Overview**

Our review team visited the Department of Electrical and Computer Engineering (ECE) at the University of Washington on December 4-5, 2023. Committee members reviewed a self-study produced by the department in advance of the visit. During the site visit, we met with department leadership, faculty, graduate students, Professional Masters Program (PMP) students, undergraduates, the ECE external advisory board, and a variety of staff teams. We appreciated the hospitality, openness and dedication shown by everyone that we interacted with.

Overall, we found a department that is providing a high quality education to an ever-increasing number of students, is producing excellent research in a number of important and strategic areas, is participating in many entrepreneurial efforts and is contributing leadership across campus and beyond. We were particularly impressed by the way many recommendations from the 2012 review had been acted upon so effectively, and by the extraordinary dedication and initiative that has been taken by the leadership team.

On the other hand, the department is suffering from a shortage of resources including space, funding for faculty startups, educational infrastructure and staff. These issues are impeding the department's ability to achieve its mission and to further improve its standing. To address these issues, the department, the College of Engineering and the university need to work to convince the legislature and industrial partners of the importance of investing in ECE.

## **Recommendation for the university**

The review committee is enthusiastic about the ECE department's accomplishments and progress since its previous review, and recommends without hesitation that it be granted continuing status with a next review in 10 years.

## **Unit Strengths and Concerns**

Overall, the review committee came away with the clear impression that the ECE department meets the university's expectations of quality and reputation and that the department's strength and size are reasonably reflected in their ranking among ECE departments. We particularly noted the following strengths:

- The leadership team is highly dedicated. Professor Eric Klavins, the current department chair, is clearly going above and beyond to improve the department and to develop transparent and effective processes. It is also clear that the leadership he is providing is broadly appreciated by all stakeholders.
- The department is conducting world-class research in several traditional and emerging areas of ECE, including quantum, neuro-engineering and others. We endorse the department's strategy of striking a fine balance between covering the relevant areas of ECE while, at the same time, developing world-class strengths in a select set of areas. This is crucial for a mid-sized ECE department.
- The department is providing high quality degree programs, including a high demand, high value undergraduate degree and a revenue-generating, successful PMP program.
- The revised undergraduate curriculum has led to increased flexibility and opportunities for the students through a set of pathways that are both unique and forward-looking and could be a model for other departments nationwide.
- Based on our meetings, we generally sensed collegiality, mutual respect, and camaraderie across different groups in the department.
- The new mentorship program for assistant professors appears to be successful. In addition, the assistant professors that we met feel that they have visibility into department decision-making and that their opinions are taken into account.
- The department is making serious and impressive efforts to improve diversity, equity and inclusion, and their ability to recruit diverse faculty and students was reflected in the cross-section of people that we met during the visit.
- The department has a robust and exciting industry-sponsored capstone program.
- The department has acted on many of the recommendations from the 2012 review with very positive results (e.g., guaranteeing 4 years of funding to PhD students, forming an advisory board, increased transparency, etc.). Moreover, the addition of "C" into "ECE"

as the department name has helped expand the department's identity and boost faculty morale, not to mention bring it more in line with peers.

On the other hand, we identified the following concerns and risks:

- A shortage of resources, including funding, space and facilities.
  - The department does not have sufficient space to expand the research mission and to provide proper educational experiences for a significantly increased student population. One recurrent theme was that the educational infrastructure was aging, was inadequate for a growing student population, and was not keeping up with a rapidly evolving technological landscape. In addition, the shortage of study spaces for students and meeting spaces for informal cross-lab research discussions and social interactions is impinging on the sense of community. This was another of the recurrent themes throughout the many stakeholder meetings.
  - ECE is an evolving, highly sought-after field and more faculty are needed to properly support the growing research mission and student population. To address this, more funding is needed for faculty lines and startups.
  - The department has a shortage of PhD and postdoctoral fellowships. In particular, there are fewer such fellowships in the department than what one would expect from a program of this level of activity and prominence.
  - The staffing levels in the department are at the low end relative to the faculty and student size; this is especially true as it pertains to grants management. This increases the stress level for both faculty and staff and could affect the department's ability to retain both.
- Industry relations and external funding
  - The committee came away with the impression that there is insufficient industry engagement and industry funding. Research funding from industrial sponsors appears below what one typically would expect for an ECE department of this prominence, ranking, and research excellence. It also appears that the potential to raise money through philanthropy is not being fully exploited.
  - The external advisory board appears to be under-utilized and seemed somewhat unclear as to its own mission.
- Student-related issues
  - The total number of PhD students in the program was lower than expected, given the research activities and the size of the faculty. This seems in part to be the result of risk-averse faculty due to the guaranteed funding model for PhD students and the shortage of PhD fellowships.

- The lack of ECE-centric career fairs may have led to employment information not being disseminated as effectively as could be otherwise. This might explain why some undergraduates that we met with seemed pessimistic about career prospects.

## **Recommendations**

The continued success and impact of ECE and the enhancement of its regional and national prominence necessitates that the College of Engineering, the University of Washington, and the state invest in ECE. This investment should include faculty lines, startup support, educational and research infrastructure, space, and staff. The future health of the department also depends on increasing external investment and philanthropy, as well as industry engagement.

To convince the university, state and industry to make these investments and for its own benefit and clarity, we recommend that ECE further develop and streamline its case: for the value of the education it is providing, the importance of the research it is doing, and the economic impact it is having, both now and in the future. To this end, we suggest that the department more clearly articulate its vision, including the following:

- A data-driven case for why and how the CHIPS act has the potential to transform the local and state economies through strategic investments in ECE. This case must address questions such as: Why ECE at UW? What is ECE's competitive advantage when it comes to research in semiconductor engineering? Why the Seattle area? While this case has already been made in *general* terms, we strongly encourage the department to provide more data quantifying the need for investment in ECE, including:
  - the number and types of jobs in semiconductor engineering available now and in the future in Washington,
  - the academic preparation required for these jobs that ECE is uniquely qualified to provide,
  - ECE's central role in providing this education (versus other units on campus or other universities) and plans for curricular development,
  - the infrastructure needed to ensure that its students are well prepared for these jobs,
  - the forward-looking, CHIPS-relevant research that will be enabled by hiring additional faculty in this area,
  - comparisons to the other major academic players in the semiconductor engineering space.

The case presented should also include testimonials from companies that are supporting ECE in this endeavor, want to hire ECE students, and need to gain access to research ECE is producing. Having high level technology companies and executives put their

political capital and financial muscle behind ECE can help induce legislators to support the department and invest in a cluster hire in this area.

- A strategic planning process for how the various educational programs ECE offers will evolve in the future. This would include target enrollment numbers for PhD students, as well as PMP and MS students. For example, the department could benefit greatly from increasing the number of PhD students enrolled. To encourage faculty to make additional offers to PhD candidates, the department may need to better clarify how faculty and the department share the financial risk involved. Regarding the daytime masters program, it was not entirely clear to the committee what purpose it serves, especially relative to the PMP, and what target enrollment numbers would help serve that role. On the other hand, the PMP is understood to be a high-value proposition for its students and a source of revenue, but the growth targets and trajectory are unclear. In terms of new educational programs, we would encourage ECE to take a primary leadership role in developing an interdisciplinary educational program in semiconductor technology. This will further solidify ECE's centrality to the efforts in this area.
- A long term strategy for research growth. Despite pointing to a set of strategic areas of strength and growth, concerns were expressed by some faculty about the "identity crisis" that ECE as a discipline (and this department in particular) is facing. Locally, this seems to be aggravated by the perceived dominance of the Allen School. A clear articulation of a long-term vision for the department would help address this issue. This includes working within the department to develop a shared research vision that most, if not all, faculty can get on board with. This also entails articulating how ECE distinguishes itself from the Allen School and developing opportunities for further synergies between the two units.
- A DEI strategic plan. The department could consider creating a strategic plan for DEI that would include concrete goals, evaluation metrics, plans for data collection, and a strategy for disseminating what has worked to the broader ECE community. The department has an explicitly stated and commendable ambition to be a national leader among ECE departments in the DEI space, but of course external visibility of these efforts will not happen without a targeted and purposeful communication strategy. One concrete suggestion for how to publicize your DEI activities is by presenting them at the ECEDHA annual meeting.

Another area where the committee felt that there is significant room for growth is in relations with industry and investment from industrial partners. To help with this:

- We recommend reimagining the role and charge and possibly even the composition of the external advisory board to better utilize their expertise and help. Right now, the

committee seems overly focused on shorter term industrial hiring needs rather than helping with strategic directions, fundraising, expansion of industry partnerships, and broader alumni engagement. Possible suggestions include an onboarding process, bylaws, and working groups that are active in-between board meetings.

- The broader industrial engagement with the department seems to be somewhat ad-hoc and isolated to individual activities, such as capstone projects. The establishment of a real, industrial affiliates program could go a long way towards remedying this. More generally, the committee was not clear on the department's strategic plan for fundraising from industry or from alumni and for developing a holistic engagement model that includes significantly more philanthropy and sponsored research. The external advisory board should be able to help with this.

We present a number of other recommendations below.

- Awards: We encourage the department to create an official awards committee responsible for soliciting nominations of faculty for local, national and international awards.
- Staff: We sensed some stress and unhappiness on the part of staff. Issues that came up include interactions with disrespectful or impatient faculty and concerns about growth opportunities and retention. To better understand these issues, we recommend conducting an anonymous survey of staff. We would also recommend offering staff members the opportunity to provide feedback on faculty as part of their annual review. That feedback can be included in the evaluation of faculty as part of merit reviews. In addition, we feel that increasing the number of staff in grants management is a very high priority.
- PhD student community: We recommend working to create a stronger cohort and connections among PhD students. This is one of the pain points related to the lack of spaces in which to gather, which has resulted in PhD students feeling somewhat siloed by individual labs. The PhD students also expressed a desire to have more town halls and/or social events that were PhD only. Relatedly, it would be useful to provide more opportunities for PhD students and postdocs to present their research and network with a broad spectrum of faculty and each other, as well as to invite industrial researchers in for seminars and discussions.
- Mentoring of PhD students: It may be worth introducing individual development plans (IDPs) as a way to facilitate career and professional development discussions and align goals between PIs and research trainees, especially for those students that are not making satisfactory progress. It might also be helpful if graduate supervisory committees were selected earlier and kept active so that they can participate in annual evaluation of PhD students, provide diverse mentoring, and improve the safety net for struggling students. Mentoring sessions on academic and other career pathways would also be useful. Finally,

we would encourage the department to include quality of mentoring as a category in faculty reviews and to provide faculty with resources on how to become better mentors.

- Policies and procedures: The department has been developing better documentation for new staff hires and standardizing onboarding procedures. This is commendable and we encourage the department to continue and complete this task. Similarly, other departmental policies and procedures (e.g., space, parental leave, teaching assignments, etc) should be written down to make sure that all members of the department are treated fairly and so there is continuity as the leadership changes. As one example, there seems to be a lack of a clear (or clearly communicated) space policy and a faculty member responsible for dealing with this. In particular, the assistant professors gave us the impression that they are somewhat at the mercy of senior faculty's willingness to open up their spaces to alleviate short and long-term space needs for new faculty. If it hasn't already happened, we recommend a space audit to determine research expenditure dollars per square foot, and reassign space appropriately, especially to make sure that the assistant professors are well-supported.
- Feedback: it would be beneficial to conduct climate studies by subgroup (assistant professors, staff, PhD students, PMP students, masters students, undergrads, underrepresented subgroups, alumni) to better understand what's working well and what isn't working well. Professional support should be sought in developing questions or even administering the surveys. For example, we heard complaints from some students that they were not aware of opportunities within the department, such as ENGINE, research opportunities etc. In addition, the revised undergraduate curriculum has led to some confusion on the part of the students and concerns about prerequisite chains and other curricular issues. The extent to which these are significant issues and how they might be addressed could be elucidated as part of a climate study of undergraduate ECE majors, etc.
- The degree program names at the UG (ECE) and Grad (EE) levels are mismatched; We recommend that ECE transition all grad program names from EE to ECE.