AE 210 – Professional Topics

Project 1.2

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Title: Foundations of the Discipline

Response: A mentor is meant to help one reach their career goals, to both help them get their foot in the door and to prepare them for that step; this can mean pulling strings in their social network to set up interviews or providing advice on current job concerns. A mentor of an undergraduate student – while they can set up interviews for internships or coops – needs to help with the fundamentals of the industry first: the specific technical skills you should have, the general engineering skills you should have, and an understanding of the career's finances. My mentor, my first cousin once-removed Dr. Sean Henderson, met with me on March 19th, 2024, over a phone call to discuss some of the questions I had about the industry. Sean studied mechanical engineering at Wright State University, earning his bachelor's, master's, and Ph.D. in mechanical engineering, where modeling hypersonic plasmas and computational fluid dynamics (CFD) code were his master's and Ph.D. thesis topics respectively [1]. Upon entering the workforce, he had his first job with Bell Textron Canada, then moved to GE's main branch, and currently works at GE Aerospace. Although he majored in mechanical engineering, his work experience (and job title) is more aligned with aerospace engineering.

One of the major focuses of my discussion with Sean was the technical skills that an aerospace engineer should have – programming languages, software, and general content knowledge [1]. Sean brought up Fortran, C++, and Python as the programming languages that he used most often [1]. What surprised me about this was that Python is used often in complicated simulations. Due to its high execution time, one would think Python is not well suited for physics simulations (which often need to run on supercomputers from rental companies), but due to the ease of learning the language and many native or third-party modules for manipulating data, it is often preferable to other languages [1].

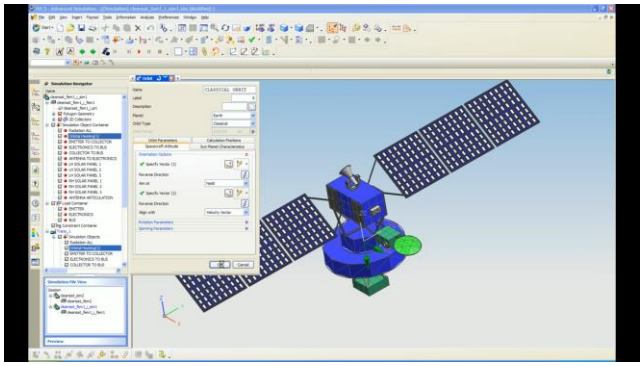

Figure 1. In-progress thermal analysis using NX (formerly known as Unigraphics) [2]

Sean did not mention much non-programming-language software, but one that I was unfamiliar with was Unigraphics (which is now known as NX, seen in Figure 1), a 3-D modeling program that provides CAD, CAM (computer-aided manufacturing), and CAE (computer-aided engineering) functions all in one software [1]. Besides being another 3-D modeling software I was

unfamiliar with, his mentioning NX and not SolidWorks (which has been the software that I have seen most often used by other students or faculty) was notable [1]. The general content knowledge that he brought up concerned the simulation of physical phenomena: CFD, FEA (finite element analysis), FNM (flow network modeling), and after a clarifying question, the definition and use of boundary conditions [1]. One of the most frightening things as an engineering student is being unknowledgeable about technical software or methods, so this discussion provided me with a fuller picture of what working as an engineer will be like (in addition to giving me specific software or software categories to research).

The next major topic of discussion throughout my interview with Sean pertained to general engineering skills, or what general engineering skills are especially important for an aerospace engineer [1]. While it is not necessarily surprising, the skills he described focused on making working as an aerospace engineer easier and/or more efficient [1]. The first category of skills he suggested acquiring were all focused on making the process of working with designs using many parts easier: learning how to read engineering drawings well and learning the relevant tolerance stack-ups [1]. Sean described that in aerospace you are often dealing with designs with many parts, and that being able to understand how the parts all fit together (and interact with one another) just from the drawings and tolerances is crucial to your work performance and efficiency [1]. The second category focused on taking design problems and breaking them down into quick calculations and estimations, all to estimate feasibility and sensibility [1]. Sean stated that large, complex models are good, but you need to have checks to make sure that things make sense, and with large models, it is easy to put in information wrong or out of order and reach the wrong conclusions [1]. Having small steps in the process where one can do mental-math reasonableness checks is a quick and easy way of avoiding such scenarios.

The final topic of discussion was the finances of an aerospace engineer in the current economy, both to get a better general understanding and to possibly alleviate some worries [1]. While some statistics are readily available to the average college student, financial considerations like retirement, insurance, salary progression, and how current aerospace engineers stack up in the housing market are not easily researched. Regarding retirement, Sean said that in his career experience, he has gotten a decently competitive full-match 401(k) plan (for the sake of privacy I will leave it at that), and it was not a big concern of his [1]. For insurance, he stated that it is cheaper in the field of engineering, but that specifically at GE the costs for insurance have been creeping up for the years (and that originally the insurance was free) [1]. Salary progression was described by Sean to be around 3-5% yearly at GE, with jumps of approximately 10% when transitioning to GE Aerospace and to a more involved job with fuel systems (in addition to 10-15% bonuses) [1]. Although he entered the housing market much earlier than I will, Sean said that on an aerospace engineer's salary, he believes that owning a home is still possible (although the first home will likely be more of a fixer-upper than what prior generations have purchased) [1]. The future housing market (as well as insurance) is a specific worry of mine, so I was thankful to hear that I would likely be able to afford it – even if it comes with some difficulty.

While I may not be ready to take the step into the workforce just yet, Sean helped me prepare for making that step by discussing the technical and engineering skills I should familiarize myself with and the finances of an aerospace engineer. I now have three different programming languages, one software tool, and three software categories to look into adding to my technical repertoire; the general engineering skills of understanding engineering drawings and reasonableness checks; and the confidence of a future of likely financial security.

References:

[1] S. Henderson, private communication, Mar. 2024
[2] TURA. *NX Space Systems Thermal Analysis.* (Sep. 30, 2012). Accessed: Mar. 21, 2024. [Online Video]. Available: https://www.youtube.com/watch?app=desktop&v=f-L2kw7Iiks