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FIRST COHORT REPORT SYSTEMS ENGINEERING TECHNOLOGY PROGRAM

ANNIE SIEJA
AUBURN UNIVERSITY
INSTITUTE FOR DIGITAL ENTERPRISE ADVANCEMENT (IDEA)
VICTORY SOLUTIONS
CALHOUN COMMUNITY COLLEGE



Systems Engineering Technology (SET)

The objective of SET is to enable and accelerate the incorporation of digital engineering and manufacturing into the workplace through education and partnerships. The vision is to provide a national collaborative center for identifying, sharing, and recommending best practices and solutions in digital engineering and manufacturing. SET is designed to be implemented at community colleges, appealing to incoming first year students and career transitioning professionals, including returning veterans.

"We have more employers wanting SET graduates than we have students in the program. Our entire first cadre of students who were eligible for internships at the deadline were employed. All have had their internships extended and have already been hired full-time. And this is before they have even completed the program. The demand for SET graduates is fierce, and we are expecting that demand to increase as more employers learn about the program."

Ron Porter, vice president of IDEA and CCC SET instructor

At the pathfinder institution Calhoun Community College (CCC) in Huntsville, Alabama, the SET program is implemented as a concentration under the existing computer information systems (CIS) associate of

applied science (AAS) degree program. The program was modified to include the six SET classes. This strategy provided time and cost advantages over creating an entirely new AAS degree and minimized procedural risks. The program requires 64 credit hours to complete and can be accomplished by a full-time student in two years. Currently, many CIS majors attend part-time, with the median time to completion for recent graduates being three years.

The SET program creates new capabilities in digital engineering and advanced manufacturing. Skills-based coursework in the two-year community college SET degree delivers workplace proficiencies in model-based systems engineering (MBSE), including Systems Modeling Language (SysML) and state-of-the-art object-oriented modeling software tools. Students learn these and other key techniques and processes to move American manufacturing forward into advanced digitalization. An internship component provides real-world, practical experience for application of skills learned. Designed specifically to expedite workforce readiness and support U.S. Department of Defense critical supply chains, this training program fuels a national imperative. The SET program also promises to invigorate an even broader spectrum of U.S. industry and strengthen economic vitality. The current industry demand for MBSE practitioners and SysML modelers far outpaces the supply of systems engineers from four-year institutions. Students graduating with a SET concentration will have the opportunity to move forward with an in-demand skillset that delivers high paying jobs across the nation.

To inform students about this new opportunity, IDEA posted advertisements on social media and met with local high school counselors. CCC designed a media campaign to spread information about SET via TV ads, print brochures, and social media platforms. Speaking with the first cohort provided valuable insight that the printed brochures in the business and CIS office at CCC were the most effective tool for reaching students.

The decision was made to offer SYS 101, the first class in the SET curriculum, as a day and night class to help accommodate the wide variety of students at community college. This first offering of SYS 101 had 30 students enrolled between the day and night classes, which exceeded the original estimate of 20 students. This gathering of individuals was truly diverse in gender, race, age, physical ability, past education, and work experience. Representation came from newly graduated high school students, dual enrolled high school students, adults returning to school to reskill, and those who wanted to advance their already successful engineering careers. Some of these students can be seen in Figure 1.



Figure 1: First SYS 101 Class, Fall 2021

IDEA and CCC held an intern job fair on December 7, 2021 so that students could become familiar with the interview process and employers could see the skillset and caliber of students being produced with this curriculum. The fair was open to all students who were enrolled in the SET curriculum at the time. Sixteen students participated, and

ten companies were represented either in person or virtually. A student meeting with representatives from the company QTEC Aerospace can be seen in Figure 2. As a result of this job fair, nine students were offered internships before they even had any modeling instruction. This proved that industry was in dire need of modeling personnel and anxious to work with these students early in the hopes of retaining them after graduation. The SET internship leverages educational investment with employers' critical needs. Information was gathered from the seven students who began working and showed that the average pay was \$20.71 per hour.



Figure 2: First Job Fair

With the first job fair showing such success, the event was repeated the next year. Though many students had been retained by their first employer, this event was crucial for students looking to transition to a new company and for students who were unavailable for employment the first year. An example of an advertisement from CCC is shown in Figure 3.



Figure 3: Job Fair Advertisement

There was excellent maturation in the first cohort, with many of them securing ongoing internships extending beyond the summer. Their success is the focus of this program, and the best gauge of their success is from the students themselves. Figure 4 is a snapshot of a video testimonial from a student in the first cohort, Zavier Jackson. The video can be found by following this link: <https://www.youtube.com/watch?v=mo5y1z7V87c>.

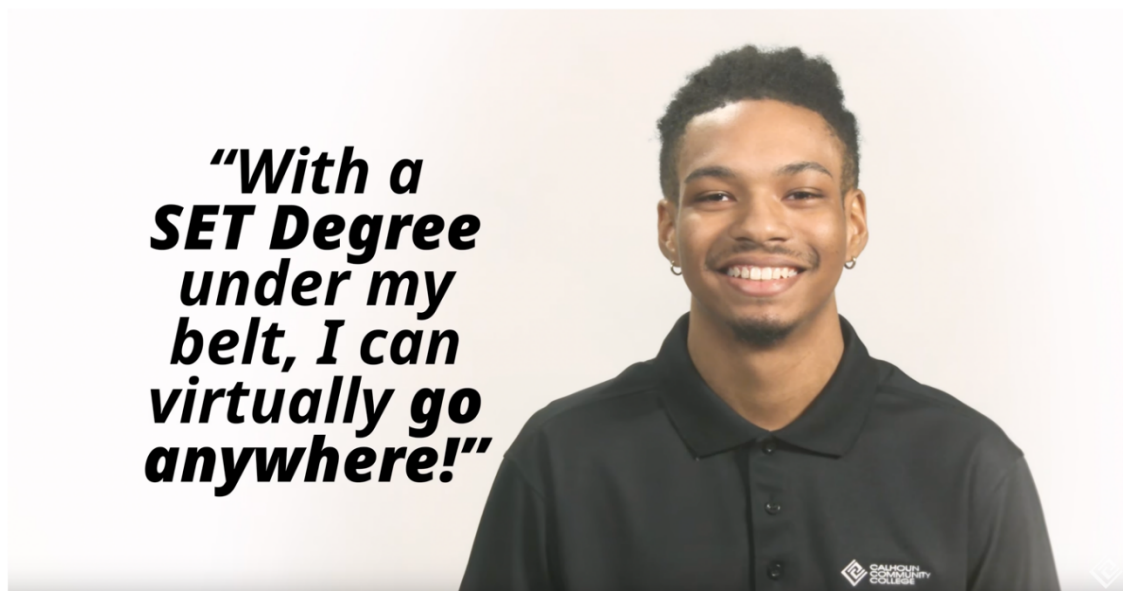


Figure 4: SET Testimonial

Many students were able to secure jobs during one or both years of the SET program, providing them with valuable experience. Table 1 shows the 12 students who comprise the first cohort and their employment status over the two years since beginning the SET program. Student 1 began the program as a full-time employee for SAIC and maintained that status throughout the program. Students 2 through 6 were hired as interns in their first year in the program and were retained by their original employer through the second year. Students 7 and 8 worked as interns both years of the program but were each employed by a different company their second year. Students 9 through 12 were unavailable for an internship the first year but were quickly employed by companies in their second year of the program. Due to the success of the job fairs, especially with the students hired early in the program being retained as employees with their original companies, IDEA saw a clear need for an apprenticeship program. An apprenticeship program would give students a chance to be hired early in the program and stay with a company until graduation, with the intention of remaining with that company full-time. The apprenticeship will enable the students to utilize their developing skillset as they learn it, while also introducing them to the professional world. This program will be beneficial to both the student and the company because while the student gains paid experience, the company can begin to mentor a potential future full-time employee. Plans are currently underway to introduce the SET Plus apprenticeship model in the fall semester of 2024 at CCC.

Student	Spring/Summer 2022	Spring/Summer 2023
1	SAIC	SAIC
2	Army DEVCOM	Army DEVCOM
3	Victory Solutions	Victory Solutions
4	Victory Solutions	Victory Solutions
5	Trideum	Trideum
6	Intrepid	Intrepid
7	StrataG	Victory Solutions
8	StrataG	Trideum
9	N/A	Victory Solutions
10	N/A	Aerojet Rocketdyne
11	N/A	Victory Solutions
12	N/A	Intrepid

Table 1: Employment of First SET Cohort

SET Capstone

In spring of 2023, the first cohort took SYS 241, the capstone course of the SET program. The purpose of this course was to provide students with the opportunity to work through a real-world problem from a local company representative of the industry surrounding the community college. Though most of the students were fortunate to be gaining experience through their internships, it was important to IDEA to build this instruction into the curriculum. Aerospace and defense constitute a majority of the industry surrounding CCC, so IDEA was incredibly grateful to have Intuitive Research & Technology Corporation sponsor the first capstone project. Intuitive provided the students with an objective, a list of requirements, and a general overview of the problem to be solved, during which the students could ask any questions they needed answered to begin the project. There were six students each in the day and night class, and the students worked as a team to solve the given problem. The teams worked throughout the entire semester to each create and modify a model using SysML and Cameo MagicDraw; their models had the potential to be used for an actual RFP. On April 27, 2023, the day and night teams presented their findings and models to an audience of family, professors, CCC employees, representatives from IDEA, media, and interested companies from the area. Figure 5 displays an example of a digital flyer created to advertise for the capstone presentations.

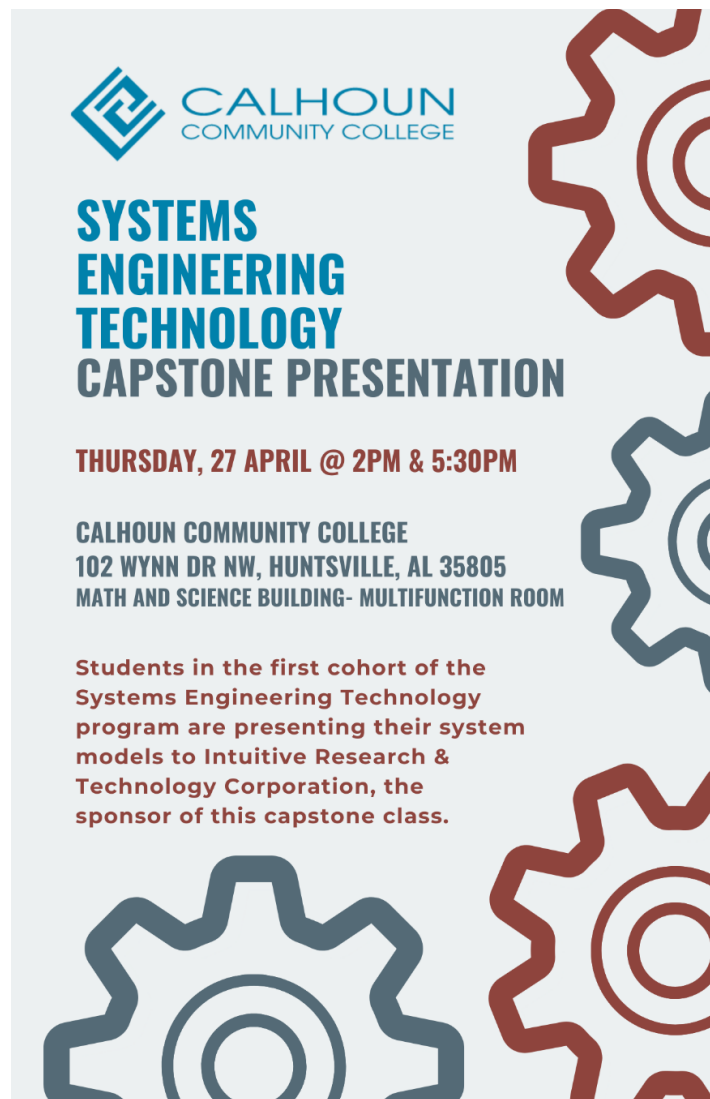


Figure 5: Capstone Presentation Flyer

After their presentations, the students opened the floor to any questions from the audience. The students were able to successfully answer all questions about their models, the capstone class, the SET program, and the experience they have gained from this curriculum. Feedback from Intuitive and other members of industry indicated that the students performed extraordinarily well and gave IDEA the confirmation that companies are seeking this skillset and that the curriculum is excelling in providing the necessary skills. A local news station, 256 Today, published an article about the presentations, allowing knowledge of this program to permeate and reach a greater audience. The article can be accessed by following this link: <https://256today.com/calhoun-engineering-program-makes-presentation-to-intuitive/>.

Figure 6 shows the day class with representatives from industry, media, IDEA, and CCC that were in attendance at the presentations. Figure 7 shows the night class with representatives from IDEA and CCC.



Figure 6: Day Class Capstone Presentation

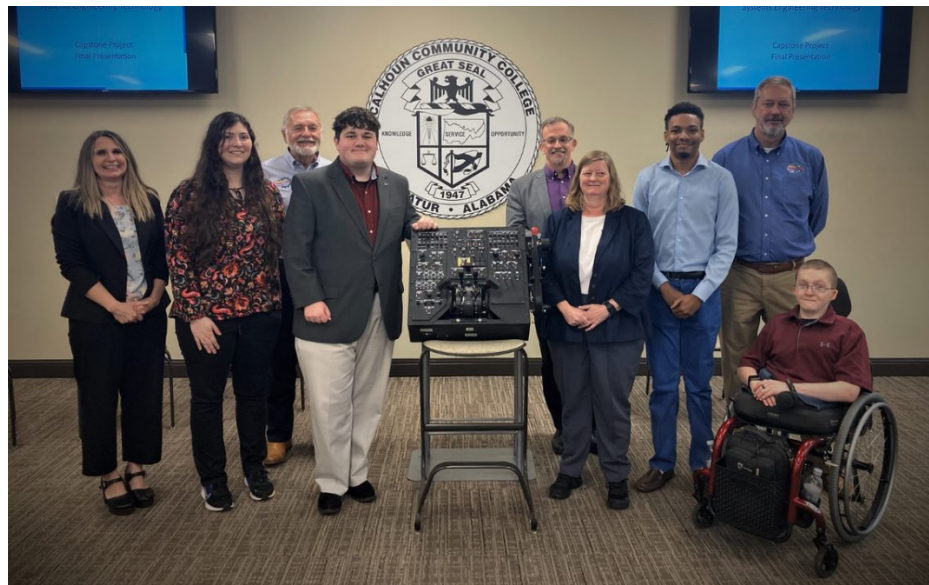


Figure 7: Night Class Capstone Presentation

SET First Cohort Data

The SET program was introduced at CCC in the fall of 2021 at a time when COVID-19 concerns were still prevalent, leading to uncertainty in potential student engagement. Despite these concerns, the first ever SET course saw 30 students enrolled, including several dual-enrolled high school students. Over the next two years, many of these students continued in the program. Due to the nature of community colleges, however, every student is not able to neatly complete their degree in the anticipated two-year timeframe, a timeframe for which the SET courses are designed. Students of the SET program are no exception, so the data is best understood given context.

As mentioned before, the introductory class had 30 participants. The capstone course had 12 participants. Due to unforeseen circumstances, one of these students was unable to complete the course. The other 11 students not only completed but excelled in the course. As of May 2023, two of these students received their Associate of Applied Science degrees in computer information systems with a concentration in systems engineering technology. Seven of the students received a short-term certificate for completion of all SET courses, enabling them with the same modeling skills as those who receive a degree with the SET concentration. One student will be finishing his courses in fall 2023 and is on track to then receive an AAS with a SET concentration. The last student has decided to continue his education by majoring in systems engineering at a four-year institution. Due to this decision, along with the fact that he had one SET course left to complete, he will not receive an AAS or short-term certificate from CCC. However, this is still recognized as a positive outcome of the SET curriculum as it has inspired this student to pursue a bachelor's degree in systems engineering. One of the students who received a short-term certificate will also be continuing his systems engineering education at a four-year institution. Figure 8 shows a selection of SET students at CCC graduation with professors from their department.



Figure 8: Spring 2023 Calhoun Community College Graduation

Though there were nine students who received an AAS or short-term certificate by May 2023, only eight of them were in the fall 2021 introductory course. One student began the program later than her peers, but still participated in the same capstone class. Given the method for calculating completion rates, this student is not included in the count for completions as she is inherently not included in the original count of 30. So, the completion rate is 27% to represent 8 of the original 30 students completing an AAS or short-term certificate.

From the first cohort, all students who were seeking employment after graduation are working, some through new or extended internships. That includes the students continuing their education at a four-year institution, demonstrating the passion these students have for the work they are doing. Three of the students from this first cohort have transitioned to full-time employees, accepting jobs from excellent engineering companies in Huntsville, AL. The salary range for full-time SET graduates is \$60,000-\$75,000, demonstrating that graduates of this program can leverage their associate degree to begin their careers with well-paying jobs in the STEM environment.

This first cohort of students proved to be a great asset to the pathfinder program throughout their journey in the SET curriculum. Many of the students have acted as ambassadors, helping to promote the program by participating in print ads, video presentations on YouTube, and news outlet interviews. A snapshot of a news story about the SET program involving Tina Sorells, a student in the first cohort, and the president of CCC is shown in Figure 9. The video can be found by following this link: <https://whnt.com/news/leadership-perspectives/calhoun-president-and-student-talk-shortage-of-systems-engineers/>.



Figure 9: WHNT Interview

The first cohort of students also aided in refining and improving instructor notes and class procedures based on their in-class experiences. Overall, the first cohort of the SET program was an immense success for the program, the school, and especially the students. Many students portrayed the sentiment that the SET program has been life-changing for them, allowing them to upskill, reskill, and have a deeply fulfilling career. With Wallace State Community College adopting this program beginning fall 2023, the impact of this skillset in a new community will be the focus of further study. IDEA looks forward to helping develop the second cohort at CCC, the first cohort at Wallace, and all future cohorts as more community colleges adopt this valuable curriculum.