UC Rockets into the 21st Century

By: Desiré Bennett

Celebrated for its storied past, the University of Cincinnati’s aerospace engineering program is the second oldest program of its kind in the country – and with its leadership in propulsion and advanced teaching capabilities, the sky is truly the limit.

The Aerospace Engineering program at the University of Cincinnati has been educating and training students in the contemporary aerospace engineering disciplines of analysis, experimentation, and design of aerospace systems since 1929 through classroom instruction and professional practice embodied in the oldest and most respected cooperative educational experience in the nation.

Over the past decade the Aerospace Engineering program has conducted millions in research annually, overseen the start-up of at least seven companies and generated in excess of $618,000 of license income for itself and the research partners of the School of Aerospace Systems. The UC School of Aerospace Systems also leads a $28 million research program focused on power and propulsion.

The aerospace program at UC has consistently exhibited a strong history of leadership, scholarship and innovation and is recognized by the Ohio Board of regents as being Ohio’s center of Excellence in Aerospace.

This comes as no surprise as the university’s relatively close proximity to a plethora of companies in the advanced propulsion and power technology industry uniquely positions the aerospace program to capitalize on many opportunities.

Professor Paul Orkwis, PhD, who was recently appointed as the head of the School of Aerospace Systems, has had work funded by NASA, the Air Force, the Army and Department of Energy as well by industry, and he understands the importance of UC’s South Western Ohio location.

“We are 10 miles from GE Aviation, which is the biggest manufacturer of gas turbine engines in the world, so we take advantage of that,” he said. “The Air Force’s propulsion directorate is in Wright-Pat and is within miles of us, and NASA Glenn, which is up in Cleveland, is the NASA center for aero propulsion.”

Each of these companies has played an integral role in the scholastic careers of many aerospace program students. Essential to the program’s success are the relationships that have been fostered with industry through joint research efforts, numerous commercialization projects and student
co-op experiences. “Our students come out with such a big advantage. By the time they’re graduating, they’ve worked five semesters in industry and understand all sorts of different jobs they’ve held,” said Orkwis. “Our curriculum, coupled with on the job experience, provides high quality engineers who go to business and business, in turn, stays in Ohio and offers more jobs. That is a real contribution that aerospace engineering at UC has definitely made to Ohio and especially in the Tri-State.”

Brandon Cook, who is the September 2012 Engineer of the month, completed a six month double Rotation at GE Aviation in Evendale, Ohio, where he learned a lot of professional and technical skills. “I was working in component tests for turbines and I really got to see the data acquisition side of things. I also learned a lot about instrumentation and data analysis,” he said. “It really helped broaden my knowledge as an engineer.”

Much like co-op experiences which broaden students’ knowledge base, student competitions, symposiums, and workshops further showcase the college’s position in aerospace engineering. Students in the aerospace program consistently demonstrate excellence by winning awards, thriving in competitions, and gaining regional, national, and international attention. Through these competitions, symposiums, and workshops, students get an opportunity to conduct research which augments their overall undergraduate education.

CEAS aerospace engineering PhD candidate and graduate student Chelsea Sabo, whose research focused on the distributing of multiple Unmanned Aerial Vehicles and the reducing effects communication constraints have on them, travelled to Ilmenau, Germany to participate in the International Graduate School on Mobile Communications at the Ilmenau University of Technology to take part in a multicopter workshop. This made her one of only eight – out of 240 applicants from all over the world – to be welcomed to the workshop and the only US student selected to participate.

Opportunities like these can be heavily attributed to the program’s distinct focus on aerospace engineering. Sabo’s advisor, Kelly Cohen, PhD, believes that UC’s Aerospace Engineering undergraduate program is very unique state-wide compared to other academic institutions in Ohio. “Most of the institutions have mechanical and aerospace engineering combined within one program,” he explains. “As a result, our undergraduate students get a better overview of aerospace specific applications which in turn translates into an interesting set of projects.”

Year after year aerospace students continue to excel in competitions such as the Society of Automotive Engineers (SAE) Collegiate Design Series Aero Design Competition, where teams triumphed in several class divisions, and the Great Midwestern Regional Space Grant Student
Rocket Competition, winning first place in a competition that is open to dozens of universities across the country!

SAE team member Zach Nieberding believes that these competitions embody a high level of excellence and truly showcase UC’s aerospace engineering students’ capabilities. “It allows the teams to demonstrate the high quality of education that the students receive in their aerospace collegiate career,” he said. “And it helps develop and instill confidence in our aerospace engineering students that they have the knowledge and skill capacity to work on real-life projects once college is over.”

The vast preparation to work on “real-life” projects that aerospace students receive from the college and its School of Aerospace Systems makes them well equipped to enter a job market of Ohio based companies which includes more than 200,000 aero propulsion jobs within the state – a sum which many graduates will join due to the aerospace program’s reputation, elite training, and leadership in the field.

Among those who have contributed to making the School of Aerospace Systems a proven leader is former head of the department, Dr. Awatef Hamed, who has made countless impacts to the aerospace department throughout her academic and professional career at the university.

Under Dr. Hamed’s direction, UC’s aerospace program thrived. This is due in part to the program’s partnerships with industry and funding from external resources, something with which Dr. Hamed is pleased. “I am proudest of bringing sources from outside [of the university],” she said. “It is necessary to develop and enhance research infrastructure to stay on the leading edge of aerospace research and development. We’ve spent millions on infrastructure over the last few years on facilities and the like.”

Among her numerous contributions, Dr. Hamed secured a $27.5 million Ohio Research Scholar award from the Ohio Department of Development in 2008 and established a Center for Intelligent Propulsion and Advanced Life Management at UC.

She was instrumental in organizing UC’s collaborative effort in obtaining a $10.8 million award to the Ohio Center for Advanced Propulsion and Power (OCAPP) of which $4.3 million was awarded, through a joint proposal, to the Aerospace Engineering department for infrastructure and research facilities.
Hamed believes that having the proper research facilities in place is paramount to building a successful program. “You attract outstanding faculty when you have the facilities – and you have to have the facilities,” she said. “This has enabled us to raise the bar and get outstanding people.”

To Dr. Hamed, this is what makes the aerospace propulsion program stand. “Our faculty makes the whole program stand out,” she said. “They are published, they do research, and they work with industry.”

Also instrumental in making the department stand out above the rest are the endowments Dr. Hamed has secured. According to Dr. Hamed, this is key. “Endowments enable us to recruit outstanding faculty,” she said.

Because of efforts like this, the school holds the unique distinction of having two Eminent Scholar Chairs – a feat that is, according to Dr. Hamed, “unheard of.” Holding these prestigious roles within the School of Aerospace Systems are Dr. Gui-Rong Liu and Dr. Ephraim Gutmark.

Dr. G.R. Liu, who is internationally recognized for his contributions to computational mechanics, meshless and advanced finite element methods, started in September 2010.

Professor Effie Gutmark, PhD, whose renowned research and development of innovative fluid engineering applications have impacted diverse technical areas including turbomachinery for power generation and automotive turbochargers, aerodynamic flight control, and biomedical applications, joined the program in September 2001.

In reference to the eminent scholars, “What’s important is that you give them money to get started which can only be done if you bring sources from outside. The goal is to recruit outstanding faculty and give them what they want,” Hamed said. “Things like labs and facilities, for example. You have to give the faculty good startup packages and part of the startup is having students to build the lab and to get it started.”

These labs and facilities are one of the many reasons the aerospace program excels. According to Gutmark, UC’s unique combination of high-tech facilities and advanced research acumen makes the university an attractive and successful partner for industry.

Gutmark’s latest research in turbomachinery, an effort to make small yet powerful engines, sparked an upgrade of UC’s Rhodes Hall facilities, making it, according to Gutmark, one of the few at an American university capable of performing the kind of complex diagnostics required for turbocharger analysis. “We have in our lab a very unique capability of providing support to industry in understanding basic phenomenon and developing new technology and applying very advanced diagnostics, experimentation and the computations to solve their problems and produce innovations that will lead them to new products,” Gutmark says.
From state-of-the art facilities, to innovative research to new technologies, UC’s aerospace department continues to trail blaze a top-flight path. In terms of UC’s leadership in the area of propulsion, “We have a large number of faculty who are dedicated to that area,” said Orkwis. “It’s kind of a natural fit – it’s a natural extension of who we are and we’ve been that for a long time.”