

## New Graduate Degree Program Development Plan Master of Science & Doctor of Philosophy in Aerospace Engineering

The PDP should address, in a summary narrative of no more than five pages (exclusive of appendices, which should be kept as brief as possible), the following concerns:

1. Designation of the new degree program, rationale for that designation, definition of the focus of the program and a brief description of its disciplinary purpose and significance.

The designation of the new programs are Master of Science in Aerospace Engineering and Doctor of Philosophy in Aerospace Engineering. These designations are appropriate to complement the existing Bachelor of Science degree Kent State University. These designations provide industry, government, and academic recognition and is easily identifiable by students and their potential employers. Such degrees will attract the highest-quality students and research faculty.

Currently there are no graduate engineering degrees at Kent State University. There is a Master of Technology (MTEC) degree. The MTEC is considered a professional degree.

The focus of these degrees is to provide graduate students a theoretical and/or research-oriented curriculum that provides significant depth in aerospace-specific disciplines. Establishment of these degrees allows the university to compete with other institutions offering engineering graduate degrees.

The purpose, significance, and importance of aerospace engineering in today's society is immeasurable. The aerospace and defense industries touch or affects almost every other discipline on Earth. Humankind's continued progress as well as protection of the planet requires engineers with specialized knowledge in aerodynamics, air propulsion, electric propulsion, wind propulsion, flight mechanics, system design and optimization, telecommunications, stability and control, orbital mechanics, space structures, and rocket propulsion.

2. Description of the proposed curriculum including identification of any specializations intended to appear on the student transcript (see Section IV).

M.S. The proposed MS curriculum requires 31.0 credits with the 1.0 credit AE graduate seminar requirement. Students can select a thesis or non-thesis option. The thesis option is recommended for students who anticipate future doctoral study. The non-thesis option is recommended for those who do not anticipate pursuing a doctoral program.

### Master of Science – Aerospace Engineering

Topic	Thesis	Non-Thesis
AE Graduate Seminar	1.0	1.0
Advanced Mathematics <sup>1</sup>	6.0	6.0
Graduate Engineering Core (to be established)	9.0	9.0
Thesis / Research Credits <sup>2</sup>	9.0	3.0
CAE Graduate Engineering Credits	6.0	12.0
<b>Total</b>	<b>31.0</b>	<b>31.0</b>

<sup>1</sup>students select two from a pre-approved list of mathematics courses.

<sup>2</sup>thesis option consists of 6.0 thesis credits and 3.0 research credits for a total of 9.0 credit hours. Non-thesis option consists of 3.0 graduate research credits.

Ph.D. The proposed curriculum requires 90 credit hours beyond the baccalaureate degree and 60 credit hours beyond the master's degree. The curricular requirements for both post-baccalaureate and post-masters options are provided in the following table.

Doctor of Philosophy – Aerospace Engineering

Topic	Post-baccalaureate	Post-masters
AE Graduate Seminar (Repeating 1.0 credit hour course)	3.0	3.0
Graduate Mathematics*	9.0	3.0
Research – Dissertation (30.0 max) & Research Credits	48.0	39.0
CAE Graduate Engineering Credits	30.0	15.0
<b>Total</b>	<b>90.0</b>	<b>60.0</b>
*students select from a pre-approved list of mathematics courses.		

In addition to the course requirements, the Ph.D. requires the successful completion of three exams: (1) qualifying exam, (2) preliminary exam, also known as a dissertation proposal, and (3) final examination, also known as a dissertation defense.

Information for both programs. No specializations will appear on the student transcript for either degree. The college will work with the Department of Mathematics to select appropriate graduate courses for these degrees.

Graduate courses in the following areas will be established. Most courses do not currently exist.

- Aerodynamics & fluid mechanics
- Mechanics & dynamics of aerospace vehicles
- System design & optimization
- Controls & autonomous systems

As research areas expand, the following areas may be considered.

- Structural mechanics & materials
- Propulsion & combustion

Course names and descriptions will follow in the full proposal. The college expects a majority of the coursework in both degrees to be combined 60000/70000 courses. The MS degree might have some 50000-level coursework, but these instances will be very limited.

### 3. Description of a required culminating, or integrated learning, experience.

M.S. The master-of-science degree requires a research component, both in the thesis and non-thesis option. For the thesis option, the culminating experience consists of 9.0 credit hours of thesis research in consultation with a thesis advisor and committee. The committee approves both the thesis topic and then accepts the final thesis after a successful thesis defense.

For the non-thesis option, the culminating experience consists of 3.0 research credit hours in consultation with a faculty advisor. At the discretion of the advisor, design and creativity projects may satisfy this requirement. At a minimum, the non-thesis activity requires a report, and a presentation and/or demonstration. A course will be established for non-thesis research.

Ph.D. The culminating experience for the Ph.D. is specialized research, leading to a definitive contribution to the candidate's research focus-area. This contribution should be of sufficient

importance to warrant publication in a recognized journal. The candidate must successfully propose and defend their research dissertation in a public setting.

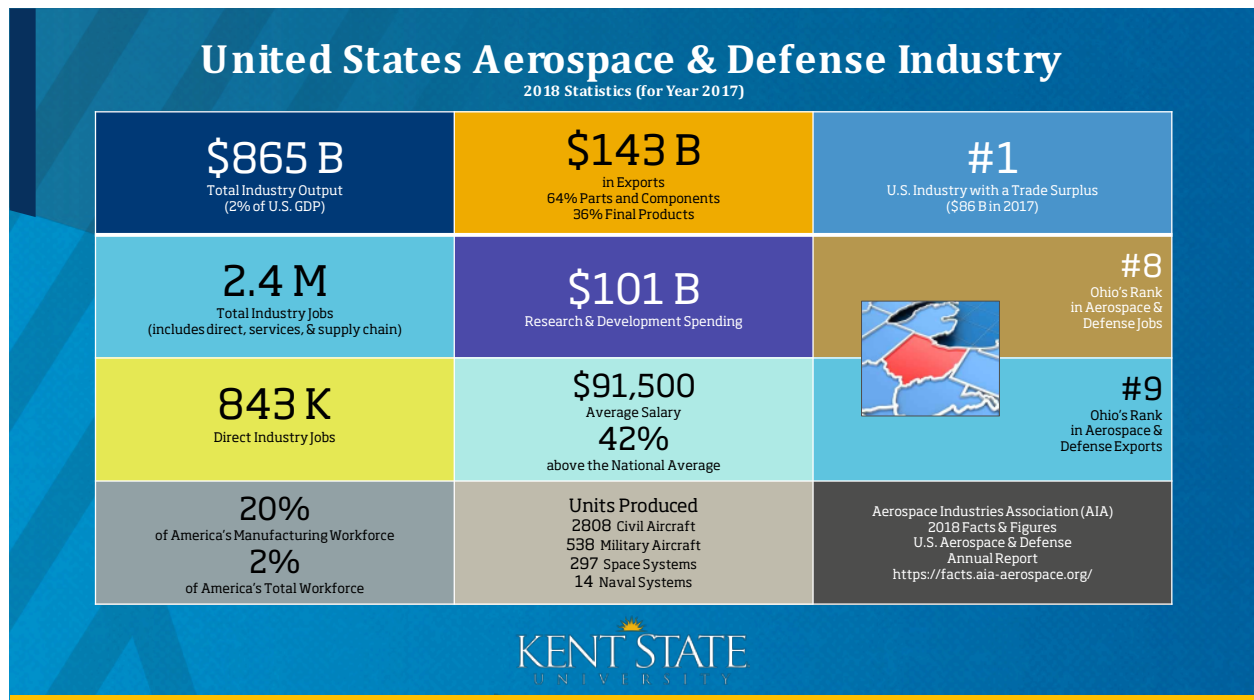
4. Administrative arrangements for the proposed program: department and school or college involved.

Both degrees will reside in the College of Aeronautics & Engineering. The faculty graduate coordinator provides oversight in conjunction with the faculty engineering coordinator. The Dean has committed administrative assistant support for the college’s graduate programs. Graduate engineering faculty will serve as student advisors.

5. Evidence of need for the new degree program, including the opportunities for employment of graduates. This section should also address other similar programs in the state addressing this need and potential duplication of programs in the state and region.

At the college level, this program is required to achieve university strategic priorities. The university prioritizes research and tenure-track faculty to increase its scholarly productivity. Tenure-track faculty have a research requirement. Research required graduate students. Graduate students require graduate programs. The college requires graduate engineering programs to attract quality faculty who can secure funding that will attract quality students to the program. Through the three previous tenure track faculty searches, every single interview candidate highlighted the paradox of a research requirement in spite of having no research-based graduate program.

The aerospace and defense industry is a significant force in the American economy. The attached graphic provides the annual statistics of the industry as compiled by the Aerospace Industries Association (AIA).<sup>1</sup>



<sup>1</sup> “2018 Facts and Figures.” Aerospace Industries Association, July 11, 2018, <https://www.aia-aerospace.org/report/2018-facts-figures/> [Accessed November 15, 2018].

The Bureau of Labor Statistics (BLS) provides its own measure of the industry, resulting in some slightly different statistics than AIA. BLS reports that the annual mean salary for 2017 was \$113,000, rather than the \$91,500 listed above. Additionally, the BLS reports that Ohio ranks #4 nationally in the number of aerospace jobs by state, rather than the #8 and #9 spots by AIA.

BLS also predicts a 6% growth in the number of aerospace engineering jobs over the next 10 years. This is consistent with the national average.<sup>2</sup> Regardless of the reporting organization, the statistics show a strong and vibrant industry with strong growth over the next 10 years.

Graduates of aerospace engineering programs are spearheading new aerospace frontiers at major manufacturers such as Boeing, Lockheed Martin, Northrup Grumman, Airbus, Bell Helicopter, Amazon, SpaceX, and Blue Origin. These rely on a host of companies as suppliers such as GE Aviation and Pratt & Whitney among hundreds of other smaller component companies. Governmental aerospace and defense agencies such as NASA and the Department of Defense employ large numbers of aerospace engineers.

Currently, the only public institutions within the state of Ohio offering graduate degrees in aerospace engineering are Ohio State University and the University of Cincinnati. Other top-tier institutions within the region offering this degree are Penn State University, Purdue University, and the University of Michigan. Case Western Reserve University offers a graduate degree in aerospace engineering, although they are a private institution. If accepted, Kent State University would be the only public institution in the northern third of Ohio to offer a graduate degree in aerospace engineering.

#### 6. Prospective enrollment.

In only its third year of existence, the Bachelor of Science in Aerospace Engineering has an enrollment of 44 students. As these students graduate, the expectation is that some of them will continue into the graduate program. A conservative estimate of initial enrollment would begin with 10 graduate students per year for the first four years. Once a full complement of faculty is assembled with adequate research capabilities, that number could double to approximately 20 students per year.

#### 7. Special efforts to enroll and retain underrepresented groups in the given discipline.

The college already takes great efforts to recruit, enroll, and retain under-represented groups in the discipline. This begins through the continuous recruitment of diverse faculty members into the college. The college has already established student organizations supporting under-represented groups and annually celebrates its international students. The college will emphasize diversity through its seminar series, by inviting diverse members of academia and industry to discuss diverse topics relevant to the college.

#### 8. Availability and adequacy of the faculty and facilities available for the new degree program.

There are currently eight faculty members (including the Dean) with doctoral degrees in engineering, physics, or applied sciences who can support this program in some capacity. An additional faculty member is joining the faculty at the start of the 2019 spring semester.

---

<sup>2</sup> Bureau of Labor Statistics, U.S. Department of Labor, *Occupational Outlook Handbook*, Aerospace Engineers, on the Internet at <https://www.bls.gov/ooh/architecture-and-engineering/aerospace-engineers.htm> [Accessed November 04, 2018].

However, given the academic rigor of graduate engineering coursework, additional faculty are required to support this program, while supporting the undergraduate programs already in place. Currently, the college has three open tenure-track faculty positions to support our engineering programs. The successful candidates for these positions will also have the credentials to support the proposed degree.

The current facilities are not adequate to support the program, but plans are in place to address facility shortcomings.

#### 9. Need for additional facilities and staff and the plans to meet this need.

There is a planned wing annex already approved for the Aeronautics & Technology Building, which will provide an additional 17,000 square feet of faculty, classroom, and research space. The university is in the process of fundraising with projected groundbreaking in 2019. With the addition of this space, current university research allocation initiatives, and additional collaborative space available through the university's design and innovation initiative, the facility issues should be adequately addressed.

#### 10. Projected additional costs associated with the program and evidence of institutional commitment and capacity to meet these costs.

Projected additional costs include those associated with additional faculty, recruiting, and moving some content online.

The following are examples of institutional commitment.

- The college has current open positions for new tenure-track engineering faculty.
- The college provides a start-up package to its tenure-track faculty and provides professional development funding for all faculty and staff.
- In Fall 2018, the college embarked on a re-structuring initiative to ensure that it operates in a manner consistent with other engineering colleges at other institutions.
- The college has launched two new undergraduate engineering programs since 2016, the first engineering programs in the history of Kent State University.
- The university conducted a thorough review of the college in 2016, which resulted in the current name and structure of the college.
- The college conducted a national dean search in 2017/18 to provide the visionary leadership necessary for achieving institutional goals.
- College infrastructure projects are among the top five infrastructure goals of the university, with construction already begun on the Airport Academic Complex, with development and fundraising of the college building extension continuing toward groundbreaking next year.